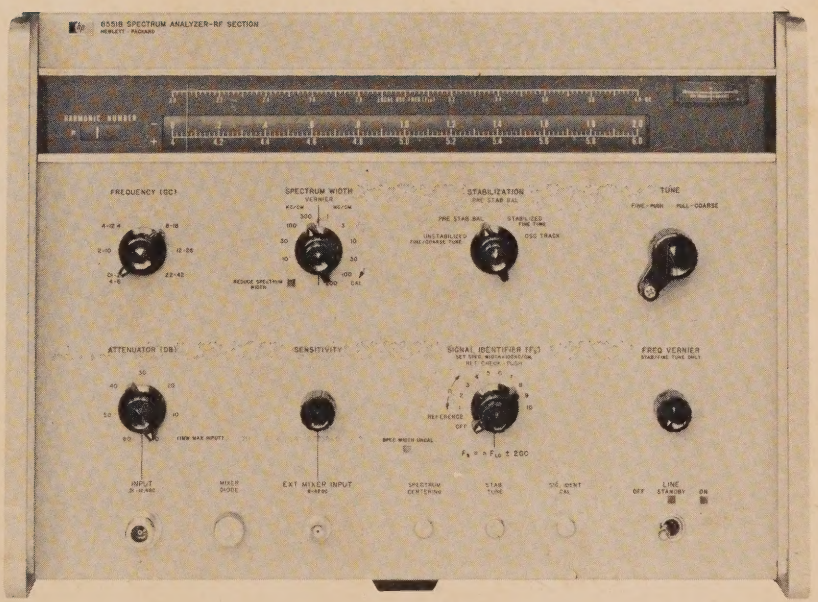
OPERATING AND SERVICE MANUAL

SPECTRUM ANALYZER RF SECTION

8551B



HEWLETT hp PACKARD

HP 8551B

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

All Hewlett-Packard products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

For any assistance contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

OPERATING AND SERVICE MANUAL

MODEL 8551B
SPECTRUM ANALYZER
RF SECTION

SERIALS PREFIXED: 746

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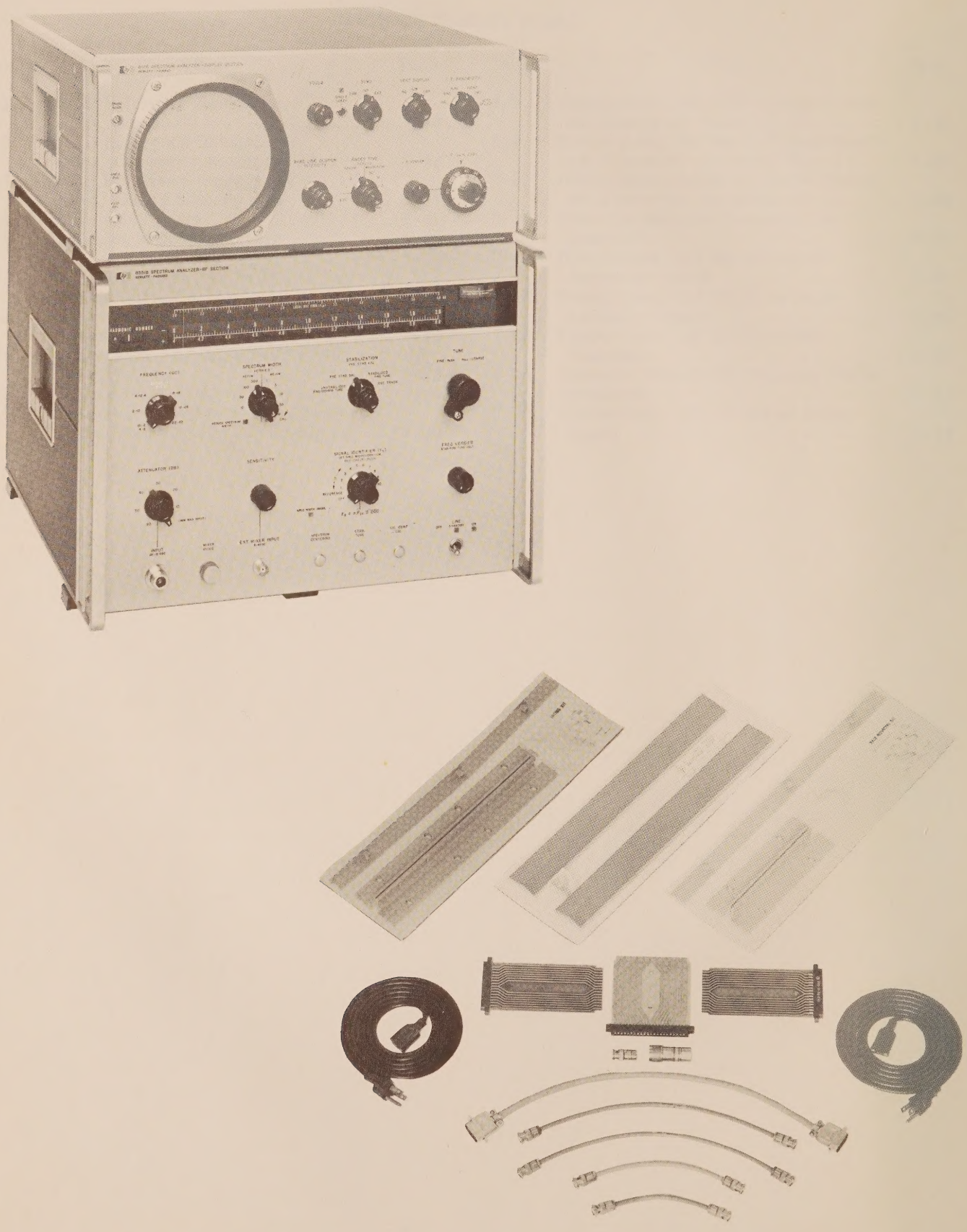


Figure 1-1. Model 8551B Spectrum Analyzer - RF Section

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The Model 8551B (Figure 1-1) is the RF Section of the Hewlett-Packard Spectrum Analyzer; the Display Section is the Model 851B. Together they comprise a receiver that electronically scans an input signal and presents a calibrated spectrum display of up to 2 Gc. Analyzer input range is from 10.1 Mc to 40 Gc, dynamic range is 60 dB, image separation is 4 Gc, and functions are calibrated. When the 8551 internal backward-wave oscillator (BWO) is used for harmonic mixing (851 set for a 10-kc IF bandwidth), Analyzer sensitivity is at least -65 dBm at the highest frequency. If an external sweep oscillator is substituted for the internal local oscillator (LO) so that fundamental frequencies may be used for mixing, sensitivities of -80 to -90 dBm are possible at the highest Analyzer frequency.

1-3. The 851B Display Section, an oscilloscope with wide dynamic range and other useful features, is described in a separate Operating and Service Manual.

Table 1-1. Specifications
(When Connected to 851B Display Section)

COAXIAL INPUT CHARACTERISTICS

Frequency Range: 10.1 Mc to 12.4 Gc. Input connector, type N female.

Sensitivity ($\frac{\text{Signal power + noise power}}{\text{noise power}} = 2$; 10 kc IF bandwidth):
10.1 Mc to 100 Mc, -98 dBm, fundamental mixing
100 Mc to 1.8 Gc, -100 dBm, fundamental mixing
1.9 to 4.2 Gc, -100 dBm, fundamental mixing (using 200 Mc 1st IF)
2.4 to 4.1 Gc, -90 dBm, second harmonic mixing
4.1 to 6 Gc, -100 dBm, fundamental mixing
6 to 8 Gc, -88 dBm, third harmonic mixing
8 to 10 Gc, -91 dBm, second harmonic mixing
10 to 12.0 Gc, -85 dBm, third harmonic mixing
With source stability better than 1 kc, greater sensitivity can be achieved using narrower IF bandwidth.

Image Separation: 4 Gc (2 Gc First IF: 400 Mc separation when using 200 Mc IF).

Residual Responses (no input signal): Less than -90 dBm referred to signal input on fundamental mixing (-85 dBm when LO is within 60 Mc of 2 or 4 Gc).

RF Input Attenuator: 0 to 60 dB in 10-dB steps (attenuator residual loss and flatness characteristics included in sensitivity and frequency response specifications). Input ac coupled; maximum dc voltage: 50V on 0-dB setting, 7V on all others.

Maximum Input Power (for 1 dB signal compression):

Input Atten Setting (dB)	Typical Max Input (dBm) (peak or average)
0	-10
10	-0
20	+10
30	+20
40 - 60	+30

Mixer Diode: Standard IN4603 replaceable from the front panel.

WAVEGUIDE INPUT CHARACTERISTICS

Frequency Range: 8.2 to 40 Gc (accessory mixers and adapters required).

Sensitivity ($\frac{\text{signal power + noise power}}{\text{noise power}} = 2$; 10 kc IF bandwidth):
8.2 to 18 Gc, -80 dBm
18 to 26.5 Gc, -75 dBm
26.5 to 40 Gc, -65 dBm

Frequency Response, Coaxial Input (includes mixer and RF attenuator response with attenuator setting $\geq$10 dB):

Frequency Range	Mixing Mode n*	Mixing Mode IF	Relative Gain (approx)**	Flatness, full range	Flatness, 100 Mc
10.1 to 100 Mc	1^-	2 Gc	0 dB	±2.0 dB	±2.0 dB
100 Mc to 1.8 Gc	1^-	2 Gc	0 dB	±1.5 dB	±1.0 dB
1.8 to 4.2 Gc	$1^\pm$	200 Mc	0 dB	±3.5 dB	±2.0 dB
2.4 to 4.1 Gc	2^-	2 Gc	-7 dB	±2.5 dB	±2.0 dB
4.1 to 6 Gc	1^+	2 Gc	0 dB	±1.5 dB	±1.0 dB
6 to 8 Gc	3^-	2 Gc	-11 dB	±2.0 dB	±1.5 dB
8 to 10 Gc	2^+	2 Gc	-7 dB	±2.0 dB	±1.5 dB
10 to 12.0 Gc	3^+	2 Gc	-12 dB	±3.5 dB	±2.0 dB

*n = LO harmonic. Normal operating range specified; full range approximately same performance.
**The relative displayed amplitudes of equal-amplitude input signals for the various harmonic mixing modes.

Table 1-1. Specifications (Cont.)

Maximum Input Power (for 1 dB signal compression): 8.2 to 12.4 Gc (using 11521A Mixer) typically -15 dBm peak or average.

12.4 to 40 Gc (using 11517A Mixer) typically -15 dBm peak or average.

External Mixer Input Connector: BNC female; LO power to mixer and 2 GC IF signal from mixer use this connector.

RF SWEEP, FIRST LOCAL OSCILLATOR (LO), AND RF TUNING CHARACTERISTICS

Spectrum Width: 10 calibrated spectrum widths from 100 kc to 2 Gc in a 1, 3, 10 sequence to 1 Gc. Vernier allows continuous adjustment between calibrated ranges and can be used to reduce width to 0. Displayed over 10-cm horizontal span on 851B Display Section CRT.

Swept Frequency Linearity: Spectrum widths 200 Mc/cm to 3 Mc/cm: Frequency error between two points on the display is less than ±10% ±3 Mc of the indicated frequency separation between the two points.
Spectrum widths 1 Mc/cm to 10 kc/cm (stabilized tuning mode): Frequency error between two points on the display is less than ±5% of the indicated frequency separation between the two points.

First Local Oscillator: 2- to 4-Gc backward-wave oscillator (BWO).

Tuning Accuracy: ±1% of LO fundamental or harmonic.

Tuning Modes: Selectable continuous coarse, fine, and stabilized (phase-locked) tuning determines center frequency about which first LO is swept. Tuning is accomplished with single front panel TUNE control (use FREQ VERNIER control for precision when in stabilized tuning mode; vernier tuning range, 100 kc).
Frequency change of LO fundamental is 200 Mc per revolution of TUNE control for COARSE, 10 Mc per revolution for FINE.

LO Stabilization Range: First LO can be phase-locked to internal voltage-tuned reference oscillator. LO tracks reference oscillator sweep for spectrum widths up to N x 10 Mc (N = harmonic number).

Stabilized Tuning: Internal reference oscillator automatically tracks with TUNE control over full LO range to retain stabilization at any LO frequency. Frequency change of LO fundamental is 10 Mc per revolution of the TUNE control. FREQ VERNIER control (100 kc tuning range) increases precision.

LO Characteristics:

Residual FM: Less than 1 kc (p-p) when LO stabilized; typically less than 40 kc (p-p) when LO not stabilized.

Noise Sidebands: More than 60 dB below CW signal level 90 kc or more away from signal, using fundamental mixing.

Auxiliary RF Output: Approximately 20 mW available at rear panel Type N female connector for use with other equipment (e.g., frequency counter, wavemeter). Requires nominal 50-ohm load impedance; coaxial termination furnished.

SIGNAL IDENTIFICATION AND SELF-CHECK CHARACTERISTICS

Signal Identifier: Signal identifier consists of two continuous switches. Outer rotary switch introduces precise frequency offsets to permit exact determination of LO harmonic number used for mixing. Direction of display shift indicates whether signal frequency is higher or lower than LO harmonic. Inner pushbutton switch permits reestablishment of reference position to facilitate identification of drifting signals.

Self-Check: First IF of 2 Gc permits use of swept LO (tuned to 2 Gc) for calibration, alignment, and general performance checks. Stabilized LO provides swept RF signal with very high linearity over 10-Mc range for IF bandwidth calibrations.

GENERAL

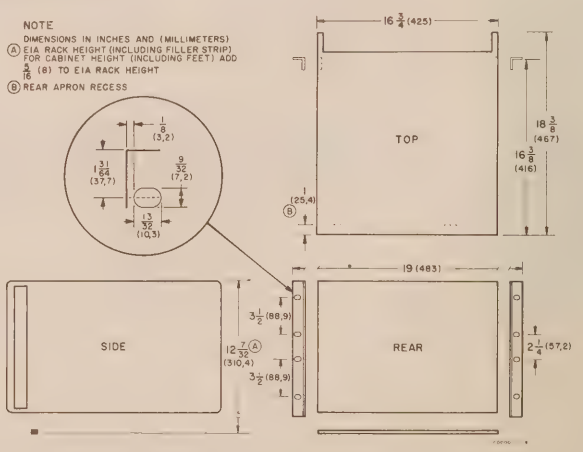
IF Output Center Frequency: 20 Mc (at rear panel BNC female connector for use with 851B Display Section).

RFI: Conducted and radiated leakage limits are below those specified in MIL-I-16910C when RF and Display Sections are fastened together with supplied joining kit.

Power: 115 or 230 volts ±10%, 50 to 60 cps, less than 275 watts (less than 330 watts, total, when 851B Display Section power supplied through 8551B rear panel switched line output).

Weight: Net 88 lb (39, 6 kg). Shipping, 134 lb (60, 3 kg).

Dimensions:



Accessory Items Furnished: See Table 1-3.

Accessory Items Available: See Table 1-2.

Table 1-2. Accessories Available

Model Number	Name	Description
11517A	Waveguide Mixer	Mixes inputs from 12.4 to 40 Gc with frequencies from first LO (BWO) hp 10503A Coaxial Cable terminated with BNC male connectors supplied with Mixer
11521A	Waveguide Mixer	Mixes inputs from 8.2 to 12.4 Gc with frequencies from first LO (BWO) hp 10503A Coaxial Cable terminated with BNC male connectors supplied with Mixer
11518A	Adapter	For mating 11517A Waveguide Mixer to P-band (12.4 to 18.0 Gc) system
11519A	Adapter	For mating 11517A Waveguide Mixer to K-band (18.0 to 26.5 Gc) system
11520A	Adapter	For mating 11517A Waveguide Mixer to R-band (26.5 to 40 Gc) system
8406A	Frequency Comb Generator	For calibrating spectrum-width function; generates precision markers with 1-, 10-, and 100-Mc spacing.
*8430A	Bandpass Filter	Pass band: 1 - 2 Gc
*8431A	Bandpass Filter	Pass band: 2 - 4 Gc
*8432A	Bandpass Filter	Pass band: 4 - 6 Gc
*8433A	Bandpass Filter	Pass band: 6 - 8 Gc
*8434A	Bandpass Filter	Pass band: 8 - 10 Gc
*8435A	Bandpass Filter	Pass band: 4 - 8 Gc
*8436A	Bandpass Filter	Pass band: 8 - 12.4 Gc
*8439A	2 Gc Notch Filter	Prevents base-line lift, resulting from 2-Gc signal, reaching 2 Gc IF Amplifier (see Note in Paragraph 3-21).
8441A	Preselector	Voltage-tunable bandpass filter; tracks selected analyzer tuning response.
*8442A	20 Mc Crystal Filter	Skirt selectivity extremely good -- passband less than 10 kc 60 dB down.
*360 series	Low-pass Filter	360A cuts off at 700 Mc, 360B cuts off at 1200 Mc.
*362A series	Low-pass Filter	Acts like bandpass when used with waveguide; available for X, P, K, R bands; eliminates signals outside normal waveguide band.

* For applications information, see Application Note 63A, Paragraph 4, HOW TO GET BEST PERFORMANCE BY USE OF FILTERS; bandpass filters discussed in AN 63, in section on RADIO FREQUENCY INTERFERENCE TESTING, Paragraph B.

1-4. DESCRIPTION.

1-5. The 8551B RF Section is a receiver that converts an input signal to an IF of 20 Mc. The 20-Mc IF is carried by external cable to the 851B Display Section.

1-6. The Analyzer obtains its broad spectrum by using as the first local oscillator (LO) a backward-wave oscillator (BWO) that generates swept bands of frequencies in the 2- to 4-Gc range. The input signal is mixed with both the fundamental and the harmonic output of this oscillator, and the product is passed to a narrow-band 2-Gc IF amplifier. This arrangement of the input virtually eliminates spurious signals. (To reduce spurious signals further, bandpass filters that attenuate out-of-band signals at least 45 dB are available for use in the 8551B input; see Table 1-2.) Since the BWO used as the first local oscillator is an electrically tuned device, the problems of backlash and

Table 1-3. Accessories Supplied

Part Number	Name	Description
08551-6038	CONTROL cable	14-conductor 18-inch shielded cable terminated at each end with 14-pin connectors
08551-6014 (2)	Sweep and IF cables	13-inch tri-shield coaxial cable terminated at each end with BNC male connectors
08551-6013	2GC cable	9-inch coaxial cable terminated with BNC male connectors
08551-6012	200MC cable	7-1/2 inch coaxial cable terminated with BNC male connectors
8120-0078	Power cable	Standard 3-conductor, 7-1/2 foot NEMA power cable
08551-6070(2)	Coaxial Termination	50-ohm coaxial load
08551-6135	Rack Mounting Kit	Hardware and parts for mounting 8551B in 19-inch rack
08551-6123 (2)	15-pin extender	Extends instrument connections to circuit board while testing and/or adjusting
08551-6122	22-pin extender	Extends instrument connections to circuit board while testing and/or adjusting
5060-0216	Kit-Joining Bracket	Straps RF and Display together, to provide a common ground
1250-0207	Coaxial Termination	50-ohm coaxial load

resettability, inherent in mechanically-tuned oscillators, are avoided.

1-7. Since BWO harmonics as well as the 2- to 4-Gc fundamental are used for mixing, far more than a 2 Gc frequency spectrum can appear on the display. This extended spectrum feature of the analyzer makes it useful for a number of applications. Although the extended spectrum is not calibrated, the frequency of any response displayed can be determined with the 8551B signal identifier.

1-8. The 8551B coaxial attenuator contributes to operating simplicity because insertion loss is low and frequency response is sufficiently flat that the attenuator can remain in the signal path at all times without decreasing maximum sensitivity. The attenuator, which is in the coaxial input, provides up to 60 dB attenuation in 10-dB steps, can handle up to 1 watt, and has zero insertion loss at 10 Mc and less than 2 dB loss at 10 Gc.

1-9. For inputs between 8.2 Gc and 40 Gc, external waveguide mixers are used with the 8551B. Two mixers are available, one for X band (8.2 to 12.4 Gc), and one for P, K, and R bands (12.4 to 40 Gc). Taper sections are available to adapt the high-frequency mixer to P, K, and R band systems and signal sources. To avoid the problem of fitting the analyzer into waveguide systems, the output of the waveguide mixer is brought out to a BNC connector, and connection is made to the 8551B via coaxial cable.

1-10. APPLICATIONS.

1-11. Application Notes 63, 63A and 63B discuss how to use the analyzer and interpret the displays; these Notes can be obtained through the Hewlett-Packard Sales Offices in your area. A very brief discussion of a few of the many uses for the analyzer follows:

1-12. The wide spectrum that is displayed makes the analyzer useful for applications such as adjustment of signal sources, observation of sidebands, detection of spurious signals, calibration of attenuators and wavemeters, determining filter Q, and investigating the bandpass characteristic of filters. When analyzing a signal source at 200 Mc, for example, both the fundamental and the fourth harmonic are well within the range of the instrument. Since both signals appear on the display, the source can be adjusted while the effects of any adjustments can be observed on both signals simultaneously. Wide spectrums are especially valuable in spectrum signature work; passive filters can be used as preselectors to eliminate unwanted

signals. Use of the analyzer also simplifies adjustment of the harmonic generators used in frequency synthesis or phase-lock systems because it is easy to see and adjust for discontinuities over extended frequency spectrum.

1-13. Wide image separation and a calibrated display diminish the ambiguity that has interfered with the effectiveness of spectrum analysis displays in the past. Although the calibrated display is a full 2 Gc, there are no images; the first IF is 2 Gc, which gives an image separation of 4 Gc (except for a narrow band of frequencies near 2 Gc -- image separation here is 400 Mc). Since the position of the SPECTRUM WIDTH switch gives display calibration in frequency per centimeter, there is no need for frequency markers. The frequency relation between responses appearing in the display can be determined directly from the display, quickly and easily.

1-14. In many investigations, spectrum displays have been difficult to interpret because the frequency of the response is unknown. A signal identifier, built into the analyzer, permits the determination of the frequency of each response by indicating the harmonic of the BWO with which each is beating. The frequency can then be read from the appropriate scale.

1-15. BWO TUBE WARRANTY.

1-16. The BWO tube used as the first local oscillator is not manufactured by the Hewlett-Packard Company. Separate terms of Warranty, specified by the tube manufacturer, apply to the performance of the BWO. Warranty claim and adjustment procedures are given on a warranty form at the rear of this manual. Use this form and follow claim instructions exactly as given when returning a BWO tube for warranty adjustment.

SECTION II
INSTALLATION

2-1. INITIAL INSPECTION.

2-2. MECHANICAL CHECK. If damage to the shipping carton is evident, ask the carrier's agent to be present when the instrument is unpacked. Inspect the instrument for mechanical damage such as scratches, dents, or broken knobs. Also check the cushioning material for signs of severe stress.

2-3. PERFORMANCE CHECK. The electrical performance of the 8551B should be verified as soon as possible after receipt. Perform installation procedures contained in Paragraphs 2-5 through 2-14 and establish figure-of-merit ratings as indicated in Paragraphs 2-15 through 2-26. A detailed performance check suitable for incoming inspection is given in Paragraphs 5-8 through 5-44.

2-4. CLAIM FOR DAMAGE. If the 8551B is mechanically damaged or fails to meet specifications on receipt, notify the carrier and the nearest Hewlett-Packard office immediately. (A list of field offices is at the back of this manual.) Retain the shipping carton and the packing material for the carrier's inspection. The field office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. LOCATION.

2-6. MAGNETIC INTERFERENCE. Do not locate the analyzer near a strong magnetic field; magnetic interference can be detrimental to performance.

Note

The 8551B itself can be detrimental to other devices sensitive to magnetism since the 8551B contains a permanent magnet; therefore, there is a strong magnetic field within the instrument whether it is operating or not. Do not place devices sensitive to magnetism near the analyzer.

2-7. COOLING SYSTEM. Allow at least a 3-inch clearance at the rear of the instrument for circulation of air. The 8551B uses forced-air cooling; filtered air is drawn into the cabinet by a fan and exhausted through a screened vent. Fan, filter, and screened vent are located on the rear of the instrument.

a. To maintain adequate ventilation, inspect the air filter frequently, and clean the filter as soon as it appears to be even slightly dirty.

b. The fan should be lubricated approximately every six months.

2-8. CONNECTIONS.

2-9. Connect the two sections of the analyzer:

a. Place the Model 851B Display Section on the Model 8551B RF Section.

b. To obtain the best common ground for the two sections, strap them together with the plates provided in the joining kit supplied with the analyzer. General instructions are supplied with the kit.

c. Six cables and two coaxial terminations are supplied with the analyzer; connect these as indicated in Figure 2-1.

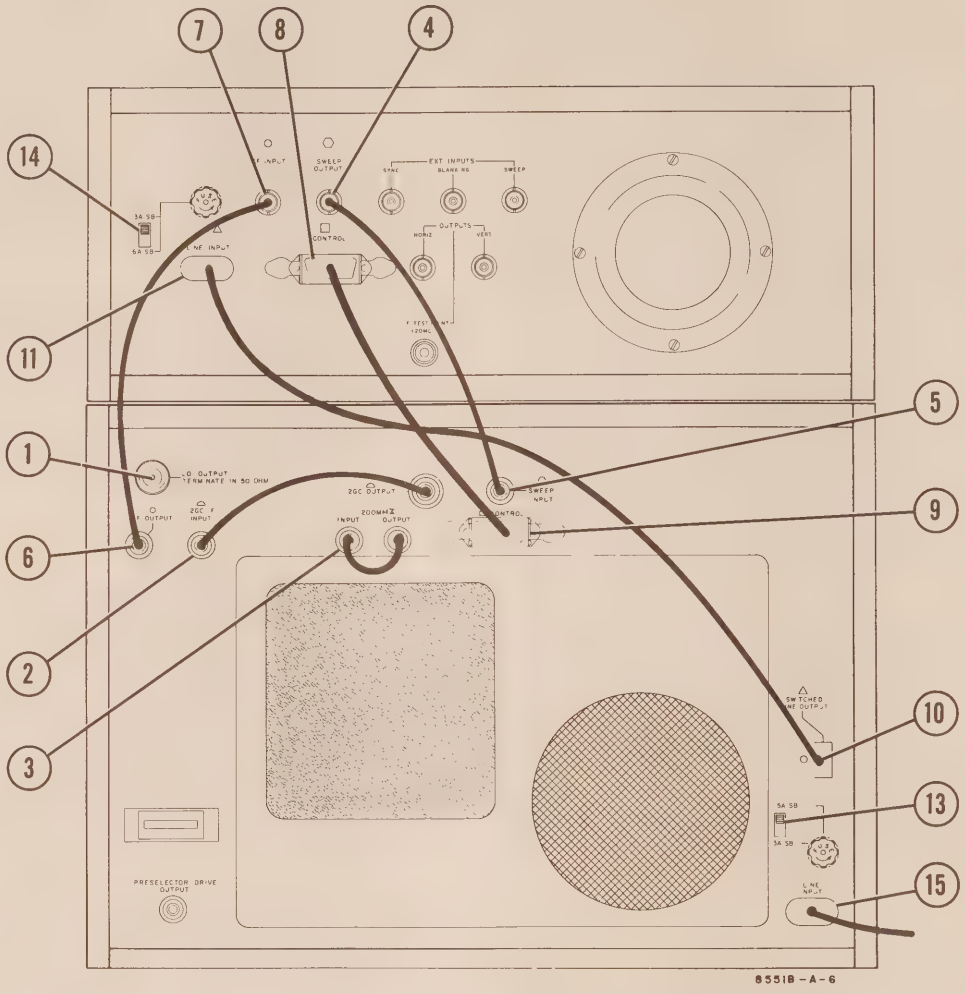
2-10. POWER REQUIREMENTS.

2-11. POWER REQUIREMENTS. The analyzer can be operated from either 115 or 230 volts ±10%, 50 to 60 cycles and requires approximately 330 watts. The line input is applied to the Model 8551B RF Section, and power is extended to the 851B Display Section by external cable. (The initial operating procedure is given in Figure 3-3.)

2-12. INPUT TRANSFORMER CONNECTIONS. Both sections are equipped with input transformers. Primary windings on each input transformer can be connected in series or in parallel; changing from one type of connection to the other is by operation of a slide switch (115/230) located on the rear panel (see Figure 3-2). Always check the setting of the slide switches in both sections before plugging the analyzer into a power source; the setting of the 115/230 switch must agree with the voltage of the power source. Refer to Figure 2-1 for sequence of the plug-in procedure.

2-13. FUSES. The fuses installed at the factory are for 115-volt operation. When operating from 230 volts, use fuse of the value shown adjacent to the 230-volt position of the slide switch.

2-14. POWER CABLE. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panel and cabinet be grounded. The analyzer is equipped with a three-conductor power cable; the third conductor is the ground conductor, and when the cable is plugged into an appropriate receptacle, the instrument is grounded. The offset pin on the power cable three-prong connector is the ground connection. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter, and connect the green lead on the adapter to ground.



1. 08551-6070 Coaxial Termination: install in LO OUTPUT - TERMINATE IN 50 OHM.
2. ⌓ Connect 2GC OUTPUT to 2GC IF INPUT.
3. Connect 200 MHZ INPUT to OUTPUT.
4,5. ⬡ Connect SWEEP OUTPUT to SWEEP INPUT.
6,7. ◯ Connect IF OUTPUT to IF INPUT.
8,9. □ Connect 851B CONTROL to 8551B CONTROL.
10,11. △ Connect 8551B SWITCHED LINE OUTPUT to 851B LINE INPUT.
12. Set LINE to OFF.
13. 8551B line voltage switch: set for nominal voltage of power source (set with blade of screwdriver); check that fuse is value marked adjacent to selected setting.
14. 851B line voltage switch: set to same setting as set at 8551B line voltage switch; check that fuse is proper value for voltage set.
15. LINE INPUT: Connect to 115/230V, 50- to 60-cps, 330-watt source.
16. 1250-0207 Coaxial Termination: install in EXT MIXER INPUT when using internal mixing signal.

Figure 2-1. Installation Connections, Model 851B/8551B Spectrum Analyzer (Sheet 1 of 2)

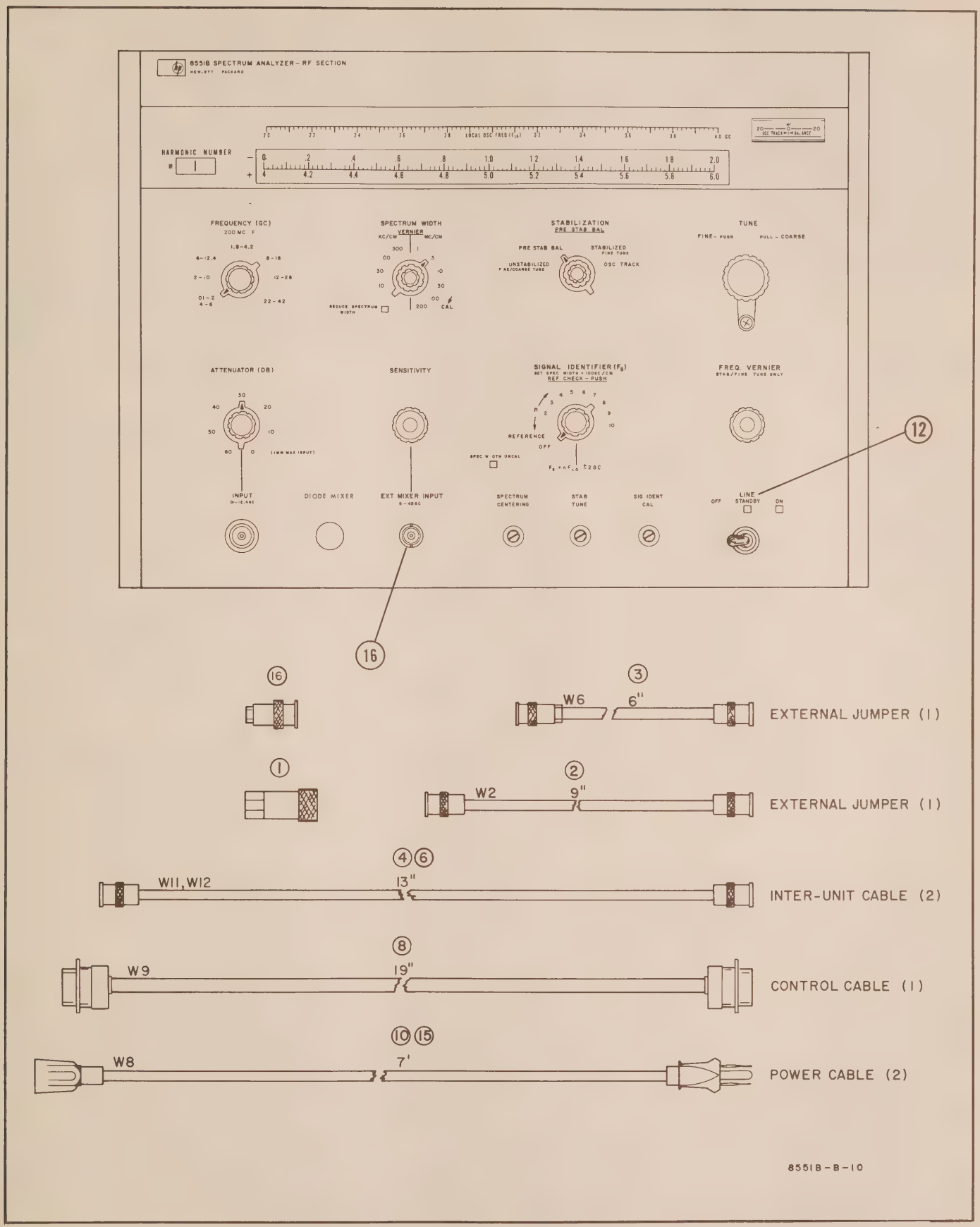


Figure 2-1. Installation Connections, Model 851B/8551B Spectrum Analyzer (Sheet 2 of 2)

2-15. ESTABLISHING FIGURE-OF-MERIT RATINGS.

2-16. Immediately following the initial inspection, it is good practice to establish figure-of-merit ratings for your analyzer, one for the input diode in Mixer A3, and another for the BWO and the IF amplifiers which follow the input mixer. Space is left in each procedure (Paragraphs 2-17 and 2-18), to record the figure obtained and frequency used in obtaining it. Throughout the life of the components for which these checks establish a rating, the figure-of-merit can be used to determine whether the circuits are performing at the level of excellence they had when shipped from the factory.

2-17. CHECK OF BWO OUTPUT POWER AND IF AMPLIFIERS.

Note: No input signal is required for this check.

a. Follow steps 1 through 4 of the initial turn-on procedure, Figure 3-3, using the following settings:

FREQUENCY(GC) 01-2
SPECTRUM WIDTH VERNIER . . . . . CAL
SPECTRUM WIDTH . . . . . 1 MC/CM
TUNE . . set at 2.0 Gc on LOCAL OSC FREQ scale
VERT DISPLAY . . . . . LOG
I.F. BANDWIDTH 100KC
I.F. VERNIER . . . . . max ccw

b. Adjust I.F. GAIN(DB) to obtain a full-scale presentation on the CRT.

c. I.F. GAIN(DB) setting _____ (required for full-scale presentation).

Note

If later checks require more gain than that recorded in step c, the BWO has probably lost power output or the IF amplifiers are not functioning properly.

2-18. INPUT DIODE.

2-19. RELATIVE CONVERSION LOSS OF COAX MIXER ASSEMBLY

2-20. EQUIPMENT REQUIRED.

a. UHF Signal Generator (8614A): item 11 in Table 5-1.

b. Coaxial cable terminated with Type N male connectors (11500A): item H in Table 5-2.

c. Adapter Type N female to BNC female connector (UG-349A/U): item AC in Table 5-2.

2-21. SETUP.

a. Perform step 1 of the initial operating procedure, Figure 3-3.

b. Set 851 controls as follows:

SYNC . . . . . INT
VERT DISPLAY . . . . . LOG
I.F. BANDWIDTH 100KC
SWEEP TIME . . . . . 3 MILLISEC/CM

c. Set 8551 controls as follows:

FREQUENCY(GC) 8-18
SPECTRUM WIDTH VERNIER . . . . . CAL
SPECTRUM WIDTH . . . . . 1 MC/CM
STABILIZATION . . . . . UNSTABILIZED
TUNE . . . 3.8 Gc on LOCAL OSC FREQ(f_{LO}) Scale
ATTENUATOR(DB) 10
SIGNAL IDENTIFIER(F_S) . . . . . OFF
LINE . . . . . ON

2-22. PROCEDURE.

a. Set signal generator for 2 Gc at -30 dBm.

b. Connect signal generator to EXT MIXER INPUT.

c. Tune signal generator for maximum display amplitude on display CRT.

d. On 851, adjust I.F. GAIN(DB) to position display on some convenient reference, such as the 10 dB axis.

e. Unplug signal generator from EXT MIXER INPUT, and connect to INPUT.

f. Set FREQUENCY(GC) to .01-2. Do not change any other controls on 851/8551 during the following steps.

g. Tune signal generator to 1.8 Gc for maximum presentation on 851 CRT. (On 8614A, adjust ΔF to peak the analyzer display.)

h. The difference in dB between the reference set in step (d) and the peak signal amplitude obtained in step (g) minus 10 dB is the relative conversion loss of Coax Mixer Assembly.

i. Record.

(1) Frequency setting of signal generator ____ Gc.

(2) Relative conversion loss of Coax Mixer _____ dB. (Typical relative conversion loss value is 12 dB.)

Note

Later performance of this check will indicate if too much power has been applied to Input Diode A3CR1 during operation. If the relative conversion loss is greater than that recorded in step f, the diode is damaged.

2-23. RELATIVE GAIN, HARMONIC MIXING.

2-24. This check not only establishes a figure-of-merit rating for the diode in the input mixer, but provides useful operating information. The figure established is relative gain, with average gain at fundamental mixing as the reference.

2-25. EQUIPMENT REQUIRED. The procedure requires signal generators with flat frequency response characteristics. Generators with leveled output are

available in the 0.8- to 40-Gc frequency range. Generators without leveled output should be calibrated and a correction curve prepared.

a. UHF Signal Generator (8614A): item 11 in Table 5-1.

b. UHF Signal Generator (8616A): item 19 in Table 5-1.

c. SHF Sweep Oscillator (8690A w/8693A/B and 8694A/B RF Units): item 31 in Table 5-1.

d. Fixed 10-dB Coaxial Attenuator (8491A-Option 10): item 21 in Table 5-1.

e. Cable Assembly, terminated w/Type N male connectors (11500A): item H in Table 5-2.

f. Power Meter and Thermistor Mount (431B and 438A): item 15 in Table 5-1.

g. Adapter, Type N female-to-female connector (UG-29B/U): item ZA in Table 5-2.

2-26. PROCEDURE.

a. Set:

851

VERT DISPLAY . . . . . .LOG
SYNC. . . . . LINE
I. F. BANDWIDTH 1MC
SWEEP TIME . . . . . 3 MILLISEC/CM
I. F. GAIN(DB) . . . . . .
inner control 0
outer control . . . . . about 60

8551

FREQUENCY(GC) 01-2/4-6
TUNE . . . . . .*1.3 on Frequency Scale
ATTENUATOR(DB) 10
STABILIZATION. . . . . UNSTABILIZED
SIGNAL IDENTIFIER. . . . . .OFF
SPECTRUM WIDTH VERNIER. . . . . .CAL
SPECTRUM WIDTH . . . . . 100 MC/CM

8614A, 8616A . . . . . for leveled CW output

8690A . . . . . .for leveled CW output; set to reference level [see step b (1)], using power meter such as the 431B

Note

Probably, it will be necessary to attenuate the 8690A output externally. This can be done either by inserting a 20-dB coaxial attenuator in the line or by increasing the 8551 ATTENUATOR(DB) setting to 30 taking this additional attenuation into consideration when setting power meter reference level.

620A . . . .Calibrate, and use correction curve; use fixed 10-dB coaxial attenuator between 620A and 8551 INPUT.

*1.3 Gc is the center of the 0.8- to 1.8-Gc range (the range which will be swept when setting the reference in step b (1)).

b. Connect 8614A Signal Generator to 8551 INPUT.

(1) Set 8614A for 0.8 Mc at a level that is convenient for reference and which obtains a display on the 851 of 5 or 6 cm. Note and record reference level used _____ dBm.

(2) Manually sweep the 0.8- to 1.8-Gc range, and determine average amplitude across the band.

(3) At average amplitude, adjust I. F. GAIN(DB) for a convenient display reference level.

(4) Record setting of I. F. GAIN(DB) _____ and display reference level, in dB _____.

c. Replace 8614A with 8616A Signal Generator. Set SPECTRUM WIDTH to 200 MC/CM. Set signal generator for 1.8 Gc at level recorded in step b (1).

d. Manually sweep the 1.8- to 4.2-Gc range, and determine average amplitude.

e. Adjust I. F. GAIN(DB) to bring average amplitude to display reference level recorded in step b (4). Note amount of gain _____ required to return display to reference. This gain change is relative gain.

f. Using input signal at level set in step b(1), check relative gain on the coaxial bands. Settings to use and typical reading relative gain measured are provided in Table 2-1. In making the checks:

(1) Determine the center frequency of the band to be swept, and set TUNE to the center frequency as read on the Frequency Scale. Whether reading will be on the + or - scale is indicated in the Harmonic No. & Scale column of Table 2-1.

Table 2-1. Relative Gain Check

Signal Source	Band Swept (Gc)	Harm. No. & Scale	FREQ. (Gc)	SPEC. WIDTH (MC/CM)	Rel. Gain* (dB)
8614A	0.8-1.8	1^-	.01-2/4-6	100	0
8616A	1.8-4.2	$1^{\pm}$	1.8-4.2	200	0
8616A	2.4-4.1	2^-	2-10	200	7
8690A**	4.1-6.0	1^+	.01-2/4-6	200	0
8690A**	6.0-8.0	3^-	4-12.4	200	11
8690A**	8.0-10.0	2^+	2-10	200	7
8690A**	10.0-12.4	3^+	4-12.4	200	12

*Relative displayed amplitudes of equal-amplitude input signals for the various harmonic mixing modes

**8690A Sweep Oscillator requires appropriate RF Units

(2) More than one response may appear in the display when checking the last four bands (4 to 12.4 Gc). Be careful to follow the response which is the desired harmonic mixing product. This response will be that whose position on the display agrees with its frequency (with the sweep set to start at the low end, the desired response first appears at the far left, and then travels across the full display as the input is swept over the 2-Gc range).

2-27. RACK MOUNTING.

2-28. Procedure for rack-mounting the 8551B is indicated in Figure 2-2.

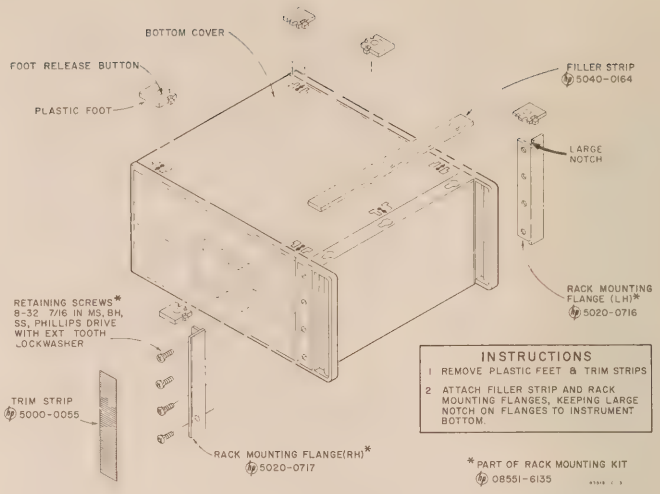


Figure 2-2. Rack-Mounting Procedure

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. The Model 851B/8551B Spectrum Analyzer is a triple-conversion superheterodyne scanning receiver with a visual amplitude-versus-frequency display. Information obtained by the 8551 RF Section is displayed on the 851 Display Section CRT. Analyzer controls are calibrated so that considerable information can be read directly from the display. Calibration accuracies for RF Section controls are given in Table 1-1; calibration accuracies for display section controls are given in the 851B manual, Table 1-1.

3-3. Basic step-by-step procedures for operating the analyzer are given in this Section of the Manual. Information on spectrum analysis and applications of the 851/8551 Spectrum Analyzer are provided in HP Application Notes 63, 63A and 63B which can be obtained through any Hewlett-Packard Field Office.

3-4. Front and rear panel controls and connectors are identified and briefly described in Figures 3-1 and 3-2. Operating procedures are given in Figures 3-3 through 3-8. Since both the RF and Display Sections are required for analyzer operation, operating plates include instructions for both units.

3-5. Switch settings for optimum operation are shown in Table 3-1. As used here, optimum is defined as the narrowest bandwidth which does not attenuate the signal because of limitations in the rise time of the 851B 20-Mc IF Amplifier. The SPECTRUM WIDTH switch is in the 8551B and the I. F. BANDWIDTH and SWEEP TIME switches are in the 851B. (With the 851B I. F. BANDWIDTH switch at AUTO SELECT, optimum bandwidth is automatically selected.)

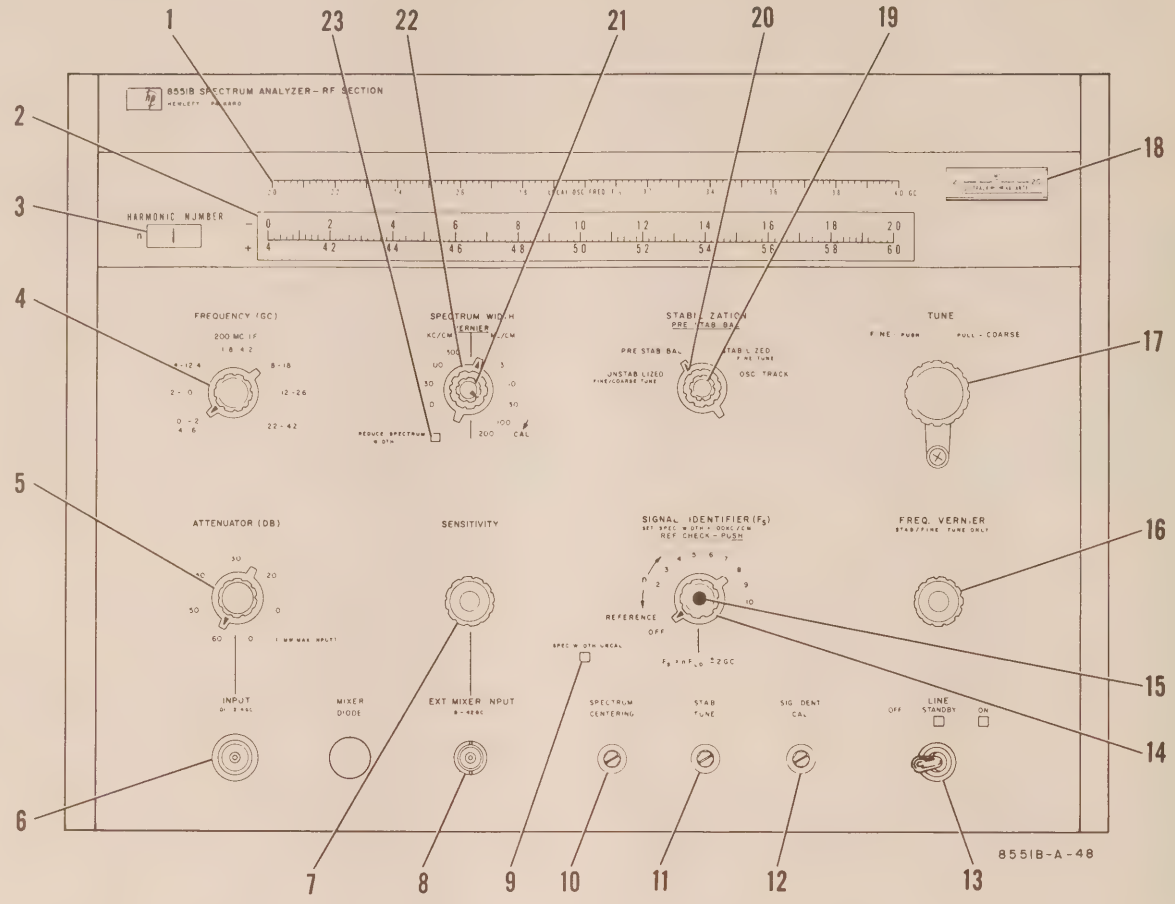
3-6. DESCRIPTION.

3-7. The 8551B RF Section includes three conversion stages, 2 Gc, 200 Mc, and 20 Mc. The first two conversions take place in the RF input circuits, and the third in the converter circuits. Mixing frequency for the 2-Gc IF is furnished by a backward-wave oscillator; mixing frequency for the 200-Mc IF is furnished by a harmonic generator driven by the same oscillator (180-Mc) that furnishes the mixing frequency for the 20-Mc IF. The 180-Mc oscillator is in the converter circuits.

Table 3-1. Optimum 851 I. F. BANDWIDTH Settings for 8551 SPECTRUM WIDTH and 851 SWEEP TIME Settings

SPECTRUM WIDTH SETTINGS	SWEEP TIME SETTINGS					
	MILLISEC/CM			SEC/CM		
	3	10	30	.1	.3	1
10KC/CM	3KC	1KC	1KC	1KC	1KC	1KC
30KC/CM	3KC	3KC	1KC	1KC	1KC	1KC
100KC/CM	10KC	3KC	3KC	1KC	1KC	1KC
300KC/CM	10KC	10KC	3KC	3KC	1KC	1KC
1MC/CM	100KC	10KC	10KC	3KC	3KC	1KC
3MC/CM	100KC	100KC	10KC	10KC	3KC	3KC
10MC/CM	100KC	100KC	100KC	10KC	10KC	3KC
30MC/CM	1MC	100KC	100KC	100KC	10KC	10KC
100MC/CM	1MC	1MC	100KC	100KC	100KC	10KC
200MC/CM	1MC	1MC	1MC	100KC	100KC	100KC

851A-A-16



1. LOCAL OSC FREQ (F_{LO}) scale: BWO fundamental frequency scale; pointer indicates BWO center frequency.

2. Frequency Scales: seven sets of scales, selected with FREQUENCY(GC) (see Paragraph 3-21).

3. HARMONIC NUMBER: identifies Frequency Scale by BWO harmonic number.

4. FREQUENCY(GC): range switch and 1/n (1/harmonic number) attenuator. Attenuates BWO tuning ramp to maintain calibration on harmonic mixing (see Paragraph 3-21), and controls Frequency Scale and HARMONIC NUMBER dials. For optimum performance in the coax range, use following setting-vs-input-signal recommendations:

.01-2/4-6	from 10.1 Mc to 1.99 Gc, and from 4.1 to 6 Gc
2-10	from 2.4 to 4.1 Gc, and from 8 to 10 Gc
4-12.4	from 6 to 8 Gc, and from 10 to 12.4 Gc
1.8 to 4.2	2 Gc ± 10 Mc and low-level signals in 1.8- to 4.2-Gc range

5. ATTENUATOR(DB): coaxial input attenuator; attenuates 10.1-Mc to 12.4-Gc inputs in 10-dB steps. CAUTION: Input to attenuator must not exceed 1 watt average, and output of attenuator should not exceed 1 milliwatt average. To protect input mixer diode:

Level at INPUT	ATTEN(DB) Setting
1 mW avg	0
10 mW avg	10
100 mW avg	20
1 W avg	30 to 60

6. INPUT: for 10.0-Mc to 12.4-Gc signals; type N female connector.
CAUTION: Manufacturer's burnout specification on input-mixer diodes is 0.3 erg. Under normal operating conditions, 1 mW average may be applied to diodes without danger of burnout. See 5. ATTENUATOR(DB) for recommended settings for various inputs. See Table 3-2 for linear operation limits.

7. SENSITIVITY: adjusts bias on external waveguide mixer diode; adjusted for optimum mixer sensitivity.

Figure 3-1. Front Panel Controls, Connectors, and Indicators, Model 8551B Spectrum Analyzer RF Section (sheet 1 of 2)

8. EXT MIXER INPUT: input for 8-Gc to 40-Gc signals; female BNC connector. Accepts cable from external waveguide mixer. CAUTION: Do not apply more than 1 mW to mixer.

9. SPEC WIDTH UNCAL: lights when SIGNAL IDENTIFIER is not at OFF and therefore 1/n attenuator (Paragraph 3-21) is out of circuit. Regardless of FREQUENCY(GC) setting, when SPEC WIDTH UNCAL is lighted BWO sweep has same width as when FREQUENCY(GC) is set for fundamental mixing (band 1 or 4).

10. SPECTRUM CENTERING: adjusts balance of Reference Differential Amplifier A13V1 in BWO tuning (power supply) circuit. Correct adjusted, BWO center frequency does not shift more than about 1 cm when SPECTRUM WIDTH setting is changes; see Paragraph 3-34 for adjustment procedure.

11. STAB TUNE: with the analyzer stabilized, adjusts tuning to reduce frequency jump which can occur as TUNE is turned through 360°; see Paragraph 3-35.

12. SIG IDENT CAL; adjusts magnitude of frequency shift which occurs when SIGNAL IDENTIFIER is set to harmonic of mixing frequency; see Paragraph 3-38.

13. LINE: power turn-on:

    STANDBY: line voltage applied to low-voltage power supplies and heater circuit: STANDBY lamp lights.

    ON: line voltage applied to high-voltage power supply; ON lamp lights.

    NOTE: expect about 1-minute delay between setting LINE to ON and high-voltage turn-on (lighting of ON lamp).

14. SIGNAL IDENTIFIER switch: used in signal-identification technique (see Figure 3-5) to identify harmonic with which input signal is mixed to obtain the display.

15. REF CHECK: for checking for input signal drift during signal identification procedure. When depressed REF CHECK returns SIGNAL IDENTIFIER electrically to REFERENCE position.

16. FREQ VERNIER: provides fine tuning with analyzer stabilized.

17. TUNE: sets BWO center frequency; see Paragraph 3-27.

    CAUTION

    To prevent damage to brake, COARSE TUNE should not be engaged when STABILIZATION switch is in the STABILIZED or OSC TRACK positions.

18. OSC TRACK BALANCE Meter: indicates phase-lock error voltage or balance of Reference Differential Amplifier A13V1, depending on setting of STABILIZATION; see Paragraph 3-23.

19. PRE STAB BAL: adjust stabilizing circuit to balance required for BWO to lock to correct harmonic of the reference oscillator; used in stabilization procedure.

20. STABILIZATION Switch: sets up connections;

    a. for metering balance of Differential Amplifier A13V1 or phase-lock error voltage (see Paragraph 3-23).

    b. for making adjustments required for stabilization.

21. SPECTRUM WIDTH VERNIER: continuously adjustable from position designation width to zero width.

22. SPECTRUM WIDTH: selects one of ten calibrated sweeps for BWO. Note: With TUNE at low or high end of band, do not set SPECTRUM WIDTH for more than 30 MC/CM; see Paragraph 3-22.

23. REDUCE SPECTRUM WIDTH: warns that sweep is not calibrated.

Figure 3-1. Front Panel Controls, Connectors, and Indicators, Model 8551B Spectrum Analyzer RF Section (sheet 2 of 2)

3-8. LOCAL OSCILLATOR (BWO).

3-9. The BWO can be set for either a swept or a CW output in the 2- to 4-Gc range.

a. Sweep width is set with SPECTRUM WIDTH, a switch that offers a choice of ten calibrated sweeps from 100 kc to 2 Gc. Sweep width can be varied continuously from a calibrated width down to zero width with the SPECTRUM WIDTH VERNIER; widths set with VERNIER are not calibrated.

b. Sweep center frequency is set with TUNE. With SPECTRUM WIDTH VERNIER set maximum ccw, the setting of TUNE determines the CW frequency. The frequency (CW or center) to which the BWO is tuned is indicated on the upper (LOCAL OSC FREQ F_{LO}) scale. The frequency to which the analyzer is tuned is indicated on the lower set of scales (Frequency Scales) provided the harmonic used to receive the signal is the same as that shown by the HARMONIC NUMBER dial. To check which harmonic is receiving the input signal, use the frequency identifying technique (Figure 3-5).

c. Rate at which the BWO sweeps is determined by the setting of the SWEEP TIME switch in the 851B. (Calibration of the display is maintained by using the same sweep to tune the BWO and to drive the horizontal plates of the 851B Display Section CRT.)

d. The incidental FM present in the output of all BWO's is significant on the narrower sweeps. The analyzer BWO can be stabilized, reducing incidental FM to less than 1 kc peak-to-peak, by locking the BWO to a reference oscillator. Stabilization procedure is given in Figure 3-4.

Note

A 10-Mc feed-through signal from the reference oscillator will appear on the display. Level of this residual is not specified as the signal is below the rated range (10.1 Mc) of the analyzer. Typically the amplitude of this residual is about -50 dBm.

3-10. RF INPUT.

3-11. COAXIAL INPUT. Signals entering the analyzer at the coaxial (10.1 Mc to 12.4 Gc) INPUT are applied through a resistive attenuator controlled by the ATTENUATOR(DB) switch. Level of signal applied to the RF attenuator can be no higher than one watt, and to protect the diode in the coaxial mixer, the signal out of the attenuator should be less than one milliwatt.

3-12. WAVEGUIDE INPUT. The input for the higher frequencies is EXT MIXER INPUT. Signals in the 12.4-Gc to 40-Gc range must be applied to an external waveguide mixer (see Figure 3-6) before entering the analyzer. To prevent damage to the waveguide mixer diode, inputs to the mixer must be less than 1 mW.

3-13. RANGE SWITCH. The analyzer range switch is FREQUENCY (GC), which maintains calibration of the display (on the 851 CRT) by switching in appropriate attenuation when harmonics of the BWO are used to receive the input signal. The attenuator controlled by FREQUENCY (GC) is referred to in this manual as the 1/n attenuator, where n = harmonic number. The 1/n attenuator is discussed in Section IV. The Frequency Scale Drum and HARMONIC NUMBER dial are ganged to FREQUENCY (GC) so the proper scale for the range and the number of the LO harmonic used to receive the signal are displayed automatically.

3-14. MIXERS. In the RF input, the input signal is converted first to a 2-Gc IF and then to a 200-Mc IF and then passed to the converter.

3-15. CONVERTER.

a. The 200-Mc IF is mixed with 180 Mc in the converter to obtain the 20-Mc IF that is passed via the rear panel IF OUTPUT and external cable to the 851B Display Section.

b. The SIGNAL IDENTIFIER switch is in the input circuit to the converter. How the circuit obtains a horizontal 2-cm shift when SIGNAL IDENTIFIER is indicating the harmonic that is receiving the input signal is discussed in Section IV. The signal identification technique is given in Figure 3-5.

3-16. CONTROLS, CONNECTORS, AND INDICATORS.

3-17. Front-panel controls, connectors, and indicators are identified and briefly described in Figure 3-1; rear-panel switches and connectors are identified and briefly described in Figure 3-2. Additional information relating to controls, connectors, and indicators is given in the following paragraphs.

3-18. COAXIAL INPUT.

a. ATTENUATOR (DB) in the coaxial input will be damaged if more than 1 watt average or 1 kilowatt peak is applied to INPUT.

b. Both Mixer/Coupler Assembly A2 (for inputs near 2 Gc) and Coax Mixer Assembly A3 (for all other inputs in the 10.1-Mc to 12.4 Gc range) include a crystal diode that will burn out if overloaded. Manufacturer's burnout rating for these diodes is 0.3 erg. Therefore, if more than a milliwatt is applied to INPUT, ATTENUATOR (DB) should be set for enough loss to bring the signal at attenuator output to less than 1 mW average. It is good operating practice to always set ATTENUATOR (DB) to 60 dB before connecting the input signal. For minimum intermodulation and internally generated spurious signals, power applied to the input diode should be less than -30 dBm.

Table 3-2. Maximum Input Powers for < 1 dB Signal Compression

ATTEN(DB) Setting	Coaxial Input[4]	Waveguide Mixers	
		11521A[2]	11517A[3]
0	0.3 mW pk		
10	3 mW pk		
20	30 mW pk		
30	300 mW pk		
40[1]	3 W pk		
50[1]	30 W pk		
60[1]	300 W pk		
		0.1 mW pk (typical)	0.03 mW pk (typical)

1 = Input to ATTENUATOR(DB) cannot exceed 1 watt average

2 = For 8.2 to 12.4 Gc operation

3 = For 12.4 to 40 Gc operation

4 = Note: Manufacturer's burnout rating for diode is 0.3 erg

3-19. WAVEGUIDE INPUT. There are also rigid limitations on power into either of the external analyzer waveguide mixers. To protect the mixer diode, inputs should never exceed a milliwatt.

3-20. INPUT MIXER DIODE CHARACTERISTICS. To minimize spurious responses, keep level of inputs to the first mixer at -30 dBm or lower. The linear region of diode output-versus-input characteristic lies at -30 dBm or below for the diode in any of the three first mixers (A2 Mixer/Coupler, A3 Coax Mixer, or external waveguide mixer). Maximum inputs for less than 1 dB of compression are given in Table 3-2.

3-21. FREQUENCY (GC) SWITCH, HARMONIC NUMBER DIAL, FREQUENCY SCALES. The range switch, FREQUENCY (GC), performs several functions:

a. It controls the 1/n attenuator (n = harmonic number) which inserts the proper value of attenuation to maintain spectrum width calibration when a harmonic is used to receive the input signal.

Note

The sweep voltage which drives the horizontal plates of the 851 CRT is used as the tuning voltage for the BWO. It enters the 8551B at SWEEP INPUT, and is applied to 8551B circuits through contacts on the FREQUENCY (GC) switch. Why the 1/n attenuator is necessary is discussed in Section IV.

b. It controls switching of signal path, as required, for the various frequency bands.

c. It controls rotation of HARMONIC NUMBER dial and Frequency Scale drum.

(1) HARMONIC NUMBER dial displays the number of the harmonic used to receive the input signal on the selected range.

(2) There are seven sets of Frequency Scales, one for each range. Each set is related to a BWO harmonic; the range of each set of scales is $nF_{BWO} \pm F_a$

where n = fundamental harmonic number

F_{BWO} = BWO fundamental frequency

F_a = frequency of first IF amplifier

More specifically:

Upper scale

= (2-4 Gc) (harmonic) - 2 Gc (all ranges except 1.8 - 4.2)
(2-4 Gc) (harmonic) - 200 Mc (1.8 - 4.2 range)

Lower Scale

= (2-4 Gc) (harmonic) + 2 Gc (all ranges except 1.8 - 4.2)
(2-4 Gc) (harmonic) + 200 Mc (1.8 - 4.2 range)

3-22. SPECTRUM WIDTH SWITCH. For longest BWO tube life, operate 8551B RF Section within the limits shown in Table 3-3.

Table 3-3. Permissible TUNE vs SPECTRUM WIDTH Settings

SPECTRUM WIDTH Setting	Permissible TUNE Setting
30 MC/CM and narrower	all
100 MC/CM	2.3 to 3.6
200 MC/CM	2.8 to 3.2

3-23. STABILIZATION. This four-position switch sets up connections for metering (on OSC TRACK BALANCE) the BWO tuning voltages to assure proper operation under unstabilized and stabilized conditions.

a. UNSTABILIZED: sets up connections for metering the balance of Reference Differential Amplifier A13V1.

b. PRE STAB BAL: Sets up connections for metering the stabilizing (error) signal from the phase-lock system prior to phase-locking the BWO to the reference oscillator.

c. STABILIZED: sets up connections for metering tracking between BWO and reference oscillator. If, after having previously been set to 0, the OSC TRACK BALANCE meter shifts off 0 when STABILIZATION is set to STABILIZED, it indicates that BWO frequency shifted when the BWO locked to a harmonic of the reference oscillator.

d. OSC TRACK: sets up the same connections as the STABILIZED position. To understand the additional function of this position it is necessary to understand something of the TUNE control.

3-24. TUNE control includes three variable resistors; the main tuning potentiometer that sets the BWO center frequency, the reference oscillator tuning potentiometer that sets the sweep center frequency, and the 2:1 potentiometer that maintains correspondence between the reference oscillator and the BWO. The three potentiometers are locked to the TUNE control, and as TUNE control is rotated, the three adjustments move synchronously.

3-25. With STABILIZATION switch set to OSC TRACK, the lock between the reference oscillator tuning potentiometer and the BWO main tuning and the 2:1 potentiometers is mechanically disengaged and a mechanical brake is applied. As TUNE control is rotated, only the reference oscillator potentiometer is varied. With STABILIZATION switch set to STABILIZED position and the reference oscillator tuning potentiometer correctly set in respect to the BWO main tuning and the 2:1 potentiometers, the BWO and reference oscillator track at the frequency for which the main tuning potentiometer is set.

3-26. PRE STAB BAL. Correct adjustment of PRE STAB BAL (see Figure 3-4) brings stabilizing circuit to balanced condition required for locking BWO to correct harmonic of reference (10-Mc) oscillator.

3-27. TUNE. Sets tuning rate and center frequency of BWO sweep.

CAUTION

To prevent damage to the TUNE control mechanical brake, COARSE TUNE should not be engaged when STABILIZATION switch is in STABILIZED or OSC TRACK (FINE TUNE only) positions.

a. COARSE: for rapid tuning across wide spectrum widths. Each revolution of TUNE shifts BWO center frequency 200 Mc, and tunes analyzer 200 Mc on 1st harmonic, 400 Mc on 2nd harmonic, etc.

b. FINE: mechanical gear shift for use on narrower spectrum widths; provides best resolution. Each revolution shifts BWO center frequency 10 Mc, tunes analyzer 10 Mc on 1st harmonic, 20 Mc on 2nd harmonic, etc.

3-28. LO OUTPUT - TERMINATE IN 50 OHM. This connector is on the 8551B rear panel. Typically more than 20 mW of BWO power is available for monitoring BWO output with counter or wavemeter or for phase-locking BWO to external reference oscillator. Unless external 50-ohm equipment is connected, the BWO must be terminated with a 50-ohm load.

3-29. OPERATING INSTRUCTIONS.

3-30. Basic techniques used in placing the analyzer in operation are given in Figures 3-3 through 3-6. Typical setups and general operating instructions for substituting an external sweep oscillator for the internal local oscillator (BWO) are given in Figures 3-7 and 3-8; also see Paragraph 3-41.

3-31. For linear operation, restrict inputs to approximately the values given in Table 3-2. To protect the input diode (A2CR1 or A3CR1) and to avoid damaging the external waveguide mixer diode, do not apply more than 1 milliwatt average to any input mixer.

3-32. If the 8551 turns off because Helix Overload Relay K4 or Filament Overvoltage Relay K3 operates, the instrument can be turned on again by switching LINE to OFF and then back to ON.

3-33. OPERATING ADJUSTMENTS.

3-34. SPECTRUM CENTERING ADJUSTMENT.

Note

No input signal is required for this adjustment, though the operator may use a CW signal of any frequency if he prefers.

a. Perform steps 1 through 14 of initial turn-on, Figure 3-3, using the following settings:

SWEEP TIME	10 MILLISEC/CM
VERT DISPLAY	LOG
I. F. BANDWIDTH	100KC
SIGNAL IDENTIFIER	OFF
FREQUENCY(GC)	.01-2
TUNE	COARSE
SPECTRUM WIDTH	10 MC/CM
SPECTRUM WIDTH VERNIER	CAL
STABILIZATION	UNSTABILIZED

b. Find 2-Gc feed-through signal with TUNE, set I. F. GAIN(DB) for convenient display, and center display with TUNE.

c. Set SPECTRUM WIDTH VERNIER maximum ccw (zero sweep), and turn SPECTRUM CENTERING screwdriver adjustment to center OSC TRACK BALANCE meter.

d. To check, set SPECTRUM WIDTH VERNIER to CAL and, while watching display, switch SPECTRUM WIDTH to 1 MC/CM; the display should not shift more than approximately a centimeter.

e. Return SPECTRUM WIDTH VERNIER to CAL.

3-35. ADJUSTMENT OF STAB TUNE.

3-36. When the 8551 is operating in the stabilized mode, with each 360° clockwise rotation of TUNE, the BWO locks to the next higher harmonic of the 10-Mc reference oscillator, and the oscillator recycles. Unless

the sweep voltage which drives the reference oscillator is set so there will be a small frequency overlap as the oscillator recycles, a portion of the frequency spectrum will be skipped when the BWO locks to the next higher harmonic. Proper adjustment of STAB TUNE results in the required overlap. Improper adjustment of STAB TUNE shows up as a forward jump in the display as TUNE is turned more than 360°. STAB TUNE should not be adjusted if display travel is backward. For example, if TUNE is turned ccw so that display travel is from left to right, and as TUNE is turned farther than 360° the display backtracks to the left and then moves forward again retraveling through a portion of the frequency spectrum, do not adjust STAB TUNE. If, on the other hand, as TUNE is turned through 360°, the display jumps forward, skipping a portion of the frequency spectrum, STAB TUNE requires adjustment.

3-37. Smooth travel of the display generally can be obtained with a slight adjustment of STAB TUNE. However, if STAB TUNE is way out of adjustment proceed as follows:

a. Turn on analyzer and let it warm up for at least a half hour.

b. Set signal generator such as the HP 606A for an output of 25 Mc at approximately -20 dBm, and connect to 8551 INPUT. Put analyzer into operation (see Figure 3-3), using following settings:

FREQUENCY(GC). 01-2
SPECTRUM WIDTH. . . . . 300 KC/CM
ATTENUATOR(DB) 10
TUNE . . . . . 2.025 on LOCAL OSC FREQ scale
VERT DISPLAY . . . . . LOG
I. F. BANDWIDTH. 10KC

c. If necessary, readjust TUNE to bring signal on display, and then stabilize (see Figure 3-4). Position signal at far left of CRT graticule with TUNE.

d. Turn TUNE ccw to move signal across CRT. At about 2.025 on LOCAL OSC FREQ scale, trace should jump backward; about 0.5 cm is typical. If trace jumps forward, adjust STAB TUNE.

e. After adjustment, check by performing step d again, readjusting STAB TUNE if necessary.

3-38. SIGNAL IDENTIFIER CHECK AND ADJUSTMENT.

3-39. CHECK.

Note

In the following, CRT graticule vertical axes are referred to by number. Axis No. 1 is at the extreme left.

a. Set: FREQUENCY(GC) 01-2
I. F. GAIN(DB). 0
LINE. . . . . .ON
SYNC . . . . . INT
SWEEP TIME. . . . . 3 MILLISEC/CM
VERT DISPLAY. . . . . LOG
I. F. BANDWIDTH 10KC

b. Set TUNE at 2.0 GC on LOCAL OSC FREQ scale. If 2-Gc self-check signal does not appear on CRT, tune to bring it on.

c. Stabilize analyzer (see Figure 3-4) with SIGNAL IDENTIFIER set to REFERENCE.

d. Check for smooth tuning by moving signal from left to right across graticule with TUNE. If there's any jump in the travel, adjust STAB. TUNE to reduce frequency jump to minimum.

e. Set SPECTRUM WIDTH to 100 KC/CM. Align signal trace with vertical axis No. 2.

f. Tune SIGNAL IDENTIFIER through positions 1 through 4. At each step, trace should shift 2 cm to the right.

g. Determine amount of error by measuring distance between signal trace and axis No. 9.

h. Again shift signal trace back toward axis No. 2. Position the trace with respect to axis No. 2 so there is same distance as was noted between trace and axis No. 9 in step g.

i. Tune SIGNAL IDENTIFIER through positions 5 - 8, and again perform steps g and h.

j. Tune SIGNAL IDENTIFIER through positions 9 and 10.

Cumulative error for the ten steps should not be more than 0.5 cm.

3-40. ADJUSTMENT. Turn SIG IDENT CAL screwdriver adjustment for best compromise across SIGNAL IDENTIFIER's 10-step range.

3-41. USING EXTERNAL OSCILLATOR AS 8551B LOCAL OSCILLATOR.

3-42. When examining signals in the higher frequency bands, the analyzer obtains a 2-Gc IF by using harmonics generated in the input mixer. However, improvement in sensitivity and frequency response may be obtained when the fundamental is used to get the 2-Gc IF, and thus the 851B/8551B are arranged so that an external sweep oscillator can be used to furnish fundamental frequencies for mixing.

3-43. Typical setups and instructions for substituting an external sweep oscillator for the 8551B internal sweep oscillator are given in Figures 3-7 and 3-8. RF power from the external oscillator should be coupled to the 8551B input mixer by directional coupler, preferably a 3-dB coupler so that the mixer-to-signal power ratio will be maximum. The external sweep oscillator

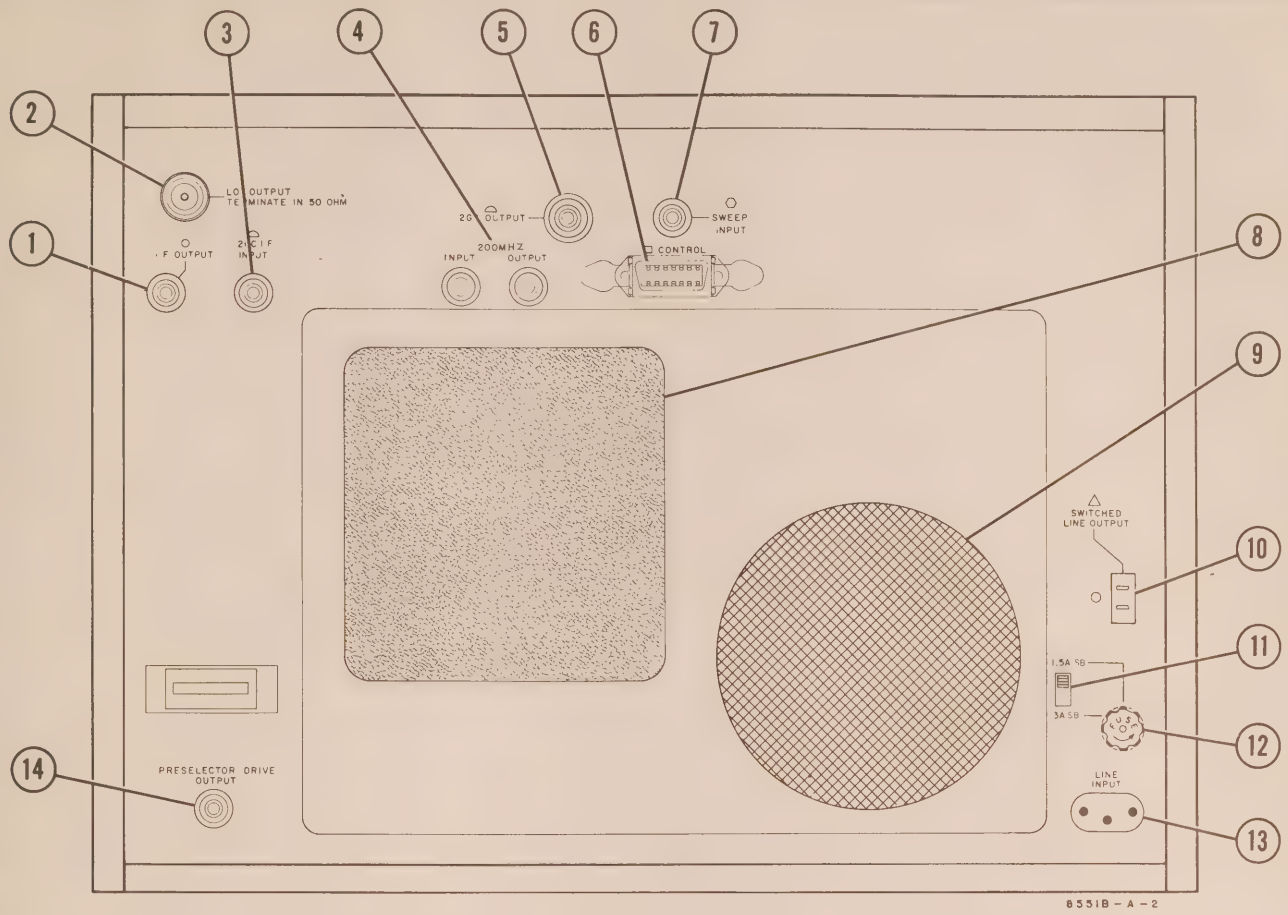
should be set to deliver frequencies such that the difference frequency in the mixer output will be 2 Gc. Typical settings for the setup shown in Figure 3-8 might be:

Input Signal (Gc)	Set External Sweep Osc (Gc)	IF (Gc)
12.4	14.4	2
14	16	2
15.7	17.7	2
17	15	2
18	16	2

3-44. The HP 8690 series Sweep Oscillators (with appropriate plug-in RF units) have the required RF power to drive the coaxial and waveguide mixers, and the required sweep voltage to drive the horizontal plates of the 851B CRT. The HP 8690 series Sweep Oscillators also provide a suitable blanking voltage.

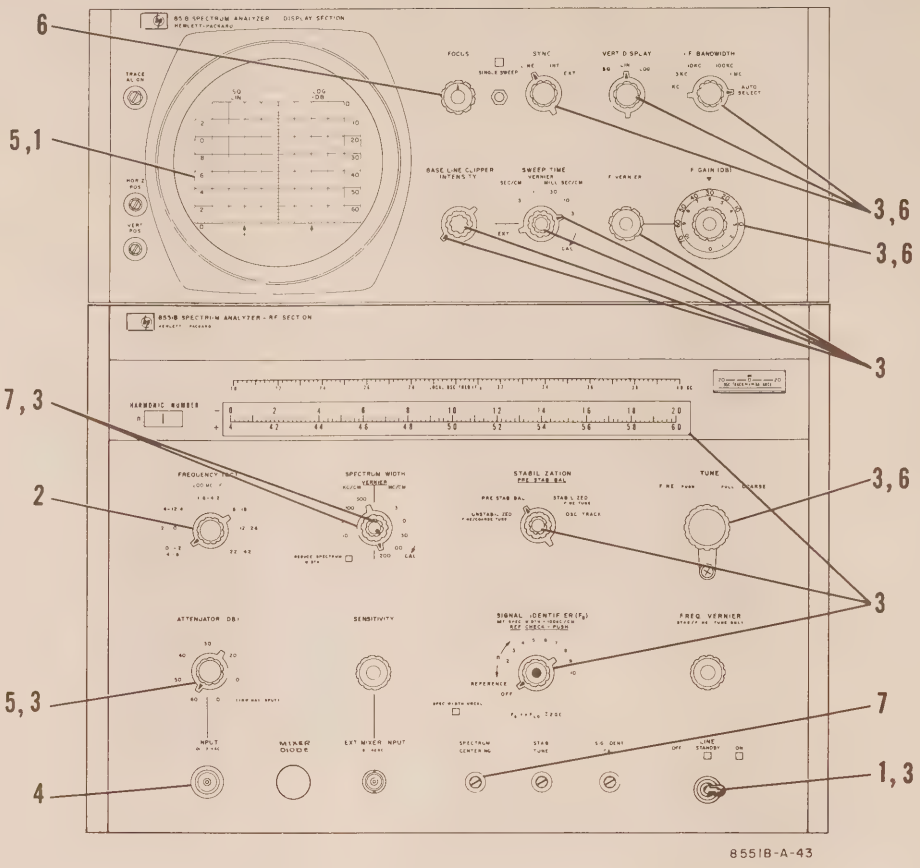
Table 3-4. Upper Limits For Stabilized Operation

FREQ(GC) Setting	Upper Limit, SPECTRUM WIDTH
.01 - 2	1 MC/CM
2 - 10	1 MC/CM
4 - 12.4	3 MC/CM
1.8 - 4.2	1 MC/CM
8 - 18	3 MC/CM
12 - 26	3 MC/CM
22 - 42	10 MC/CM



1. ◯ IF OUTPUT (J7): 20-Mc IF output from Converter; external inter-unit cable (W11) carrying 20-Mc IF to 851 Display Section connects here.
2. LO OUTPUT - TERMINATE IN 50 OHM (J10): BWO output; must be terminated with 50-ohm load unless external 50-ohm equipment is connected.
3. ⌓ 2GC IF INPUT (J4): Input to 2 Gc Mixer A7; external cable (W2) carrying 2-Gc IF from 2GC IF Amplifier A5 connects here.
4. 200 MHZ INPUT/OUTPUT (J5, J6): external cable (W6 carrying 200 Mc from RF Input to converter connects here.
5. ⌓ 2GC OUTPUT (J3): 2-Gc IF output from 2GC IF Amplifier A5; external cable (W2) carrying 2-Gc IF to 2GC Mixer A7 connects here.
6. □ CONTROL (J9): 14-conductor inter-unit cable connects here; carries ±15 Vdc from 851 Display Section and SWEEP TIME/SPECTRUM WIDTH connections required for AUTO SELECT operation.
7. ⬡ SWEEP INPUT (J8): sweep voltage input; external inter-unit cable (W12) carrying voltage from 851 sweep generator connects here.
8. Air Filter Assembly.
9. Fan Assembly.
10. △ SWITCHED LINE OUTPUT (J34): power connections between 851 and 8551 made here; cable supplied.
11. Line voltage slide switch; controls power-supply input connections. Always check that switch is set for nominal voltage of external power supply.
12. Fuseholder; rating of fuse to be used is marked near line voltage switch setting that corresponds to voltage of power supply used.
13. LINE INPUT: Connection to external power supply made here. Requirements: 115/230 volts, 50 - 60 cycles, approximately 330 watts.
14. PRESELECTOR DRIVE OUTPUT (J35): output for voltage proportional to instantaneous frequency of BWO; can be used as reference voltage for equipment such as a YIG preselector that tracks the BWO to eliminate multiple responses.

Figure 3-2. Switches and Connectors, Rear Panel, Model 8551B Spectrum Analyzer RF Section

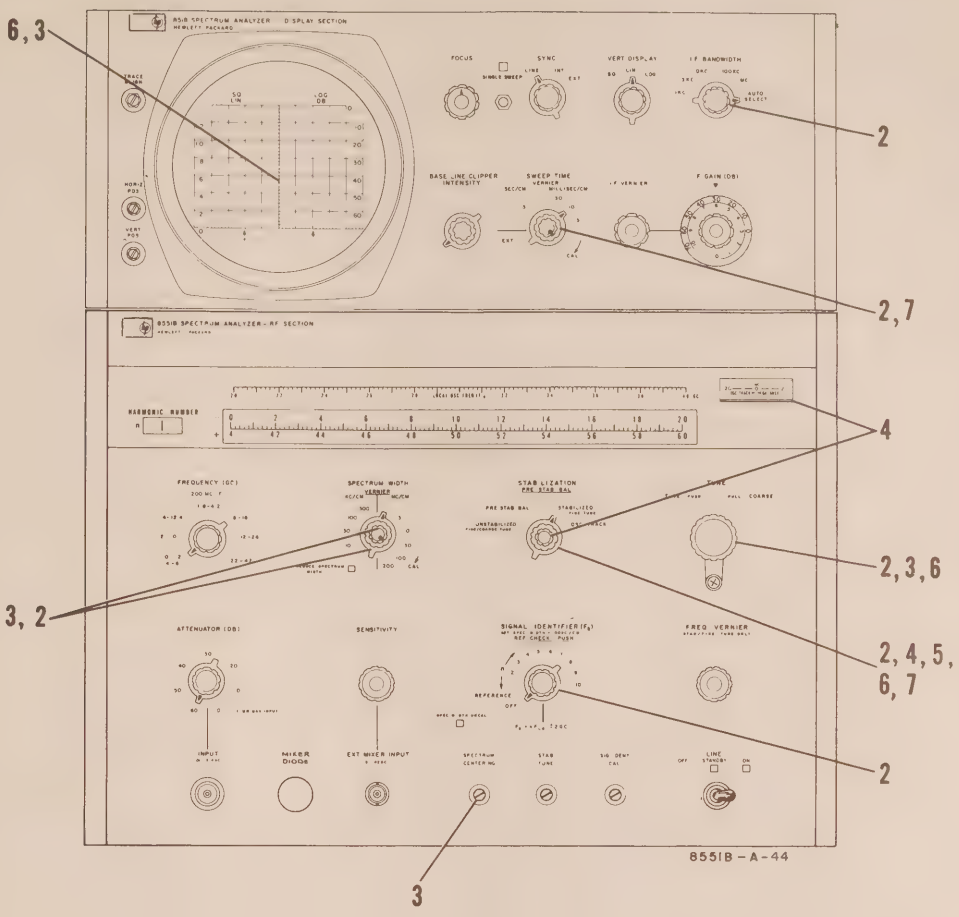


1. LINE: Set to STANDBY; light should glow, fan turn. After about 10 seconds, base line should appear on CRT. CAUTION: before setting LINE to ON, be sure fan is turning; BWO can be damaged if fan is not operating.
2. Set FREQUENCY(GC). See Figure 3-1.
3. Set: ATTENUATOR(DB). 60
   (be sure switch seats in detent)
   SIGNAL IDENTIFIER. . . . . OFF
   SPECTRUM WIDTH . . . 200 MC/CM*
   SPECTRUM WIDTH VERNIER. . . CAL
   STABILIZATION. . . . UNSTABILIZED
   TUNE. . . . . .COARSE
   Using lower (Frequency) scales, set approximately to frequency of input signal.
   BASE LINE CLIPPER . . . . max ccw
   INTENSITY . . . . . .about 3 o'clock
   SWEEP TIME . . . . . 3 MILLISEC/CM
   SWEEP TIME VERNIER . . . . . CAL
   I. F. VERNIER. . . . . .max ccw
   I. F. GAIN(DB) . . . . . .70 or 80
   SYNC. . . . . LINE
   VERT DISPLAY . . . . LIN, LOG, or SQ
   I. F. BANDWIDTH . . . .AUTO SELECT
   LINE. . . . . ON
   (indicator light will glow)
4. Connect signal under investigation; range 10.1 Mc to 12.4 Gc. CAUTION: Input must not exceed 1 watt average with ATTENUATOR(DB) set at 60; see Figure 3-1, Paragraph 3-18, and Table 3-2.
5. Adjust ATTENUATOR(DB) to bring signal on CRT. CAUTION: Signal out of attenuator should be < 1 mW. To avoid spurious responses keep input to mixer -30 dBm or less.
6. Set I. F. GAIN(DB) for convenient signal-to-noise ratio, SYNC for desired sync source; adjust TUNE to center signal on CRT, and FOCUS for sharp trace. Note: If TUNE sets pointer to extreme left, large signal will appear on CRT; this is the BWO (2-Gc) signal used for self-check, and can be ignored.
7. Adjust SPECTRUM WIDTH for best detail in region of interest. Note: If display shifts position, check SPECTRUM CENTERING adjustment, Paragraph 3-34.

*For longest BWO tube life, operate within the limits shown in Table 3-3

Note See Figure 3-9 for Model 852A/8551B Spectrum Analyzer

Figure 3-3. Initial Operating Procedure for 10.1-Mc to 12.4-Gc Inputs, Model 851B/8551B Spectrum Analyzer



1. Perform steps 1 through 7 of initial operating procedure, Figure 3-3.

2. Set: SIGNAL IDENTIFIER. . . . . OFF
   I. F. BANDWIDTH 10KC
   SWEEP TIME . . . . 10 MILLISEC/CM
   FREQUENCY(GC) 01-2

3. Adjust SPECTRUM CENTERING:

   a. Set SPECTRUM WIDTH . . . 10 MC/CM
      SPECTRUM WIDTH VERNIER max ccw
      TUNE. . . . . COARSE
      STABILIZATION. . .UNSTABILIZED

   b. Center OSC TRACK BALANCE meter with SPECTRUM CENTERING screwdriver adjustment.

4. Set: SPECTRUM WIDTH. . . . . 1 MC/CM
   SPECTRUM WIDTH VERNIER . . . CAL
   STABILIZATION . . . .PRE STAB BAL
   TUNE . . . . . .FINE

5. Center trace with TUNE, and center OSC TRACK BALANCE meter with PRE STAB BAL control.

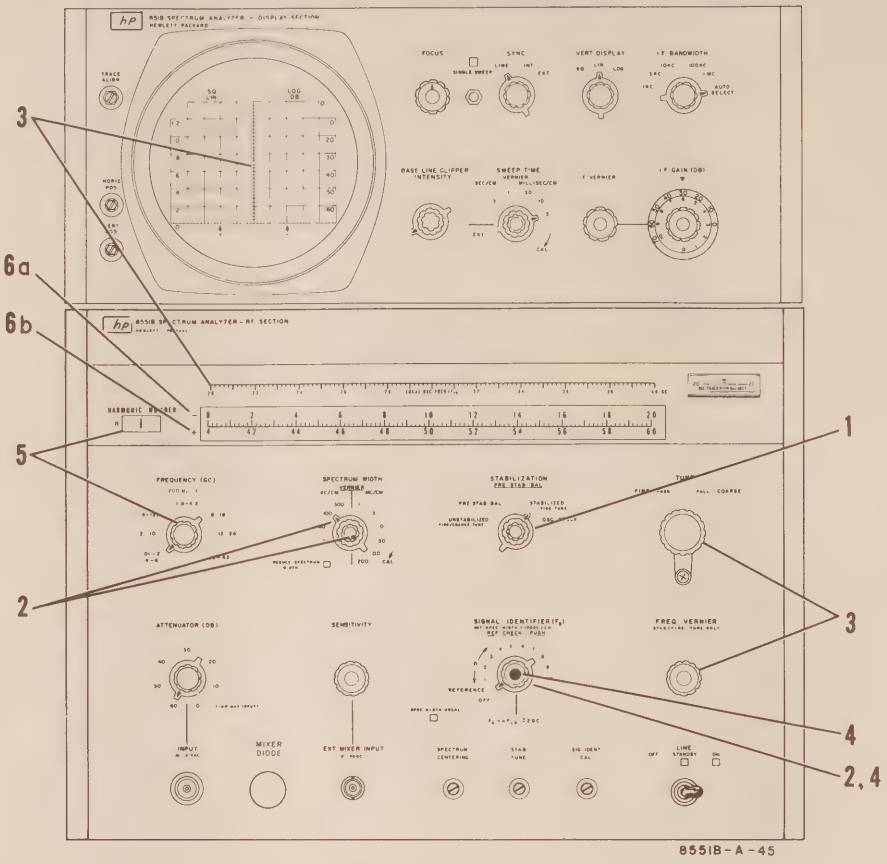
6. Set STABILIZATION to STABILIZED.

   Note: When turning STABILIZATION, be careful not to touch PRE STAB BAL adjustment.

7. If trace has shifted off center, set STABILIZATION to OSC TRACK, and center trace with TUNE. If trace cannot be returned to center with TUNE, return STABILIZATION to PRE STAB BAL, and repeat steps 5, 6, 7.

8. Return STABILIZATION to STABILIZED. Analyzer is now stabilized for calibrated spectrum widths of at least 1 MC/CM or less (see Table 3-4). Set SWEEP TIME for desired sweep rate, and I. F. BANDWIDTH and SPECTRUM WIDTH to obtain best detail in region of interest.

Figure 3-4. Stabilized Operation, Model 851B/8551B Spectrum Analyzer



1. Perform steps 1 through 7, Figure 3-3, and steps 1 through 8, Figure 3-4; leave STABILIZATION at STABILIZE, TUNE at FINE.

2. Set: SIGNAL IDENTIFIER. . . REFERENCE
   FREQUENCY(GC) . . . . . any range except 1.8-4.2*
   SPECTRUM WIDTH . . . . 100 KC/CM
   SPECTRUM WIDTH VERNIER. . . CAL

3. Adjust TUNE and/or FREQ VERNIER to set center of signal trace exactly on CRT graticule center line; this is the reference position. Note reading on upper [LOCAL OSC FREQ (F_{LO})] scale.

4. Rotate SIGNAL IDENTIFIER until CRT display shifts ±2 cm.
   a. Note direction of shift.
   b. Note setting of SIGNAL IDENTIFIER switch; this is number of harmonic which, mixed with input signal, results in a 2-Gc IF. Note: To check that input signal has not drifted, push SIGNAL IDENTIFIER center knob. This returns SIGNAL IDENTIFIER to REFERENCE position, and unless signal has drifted, signal will be centered on CRT.

5. Adjust setting of FREQUENCY(GC) while watching HARMONIC NUMBER dial indication.
   a. If harmonic number indicated by SIGNAL IDENTIFIER comes up on HARMONIC NUMBER dial, proceed per step 6.
   b. If harmonic number indicated by SIGNAL IDENTIFIER does not come up on HARMONIC NUMBER dial, proceed per step 7.

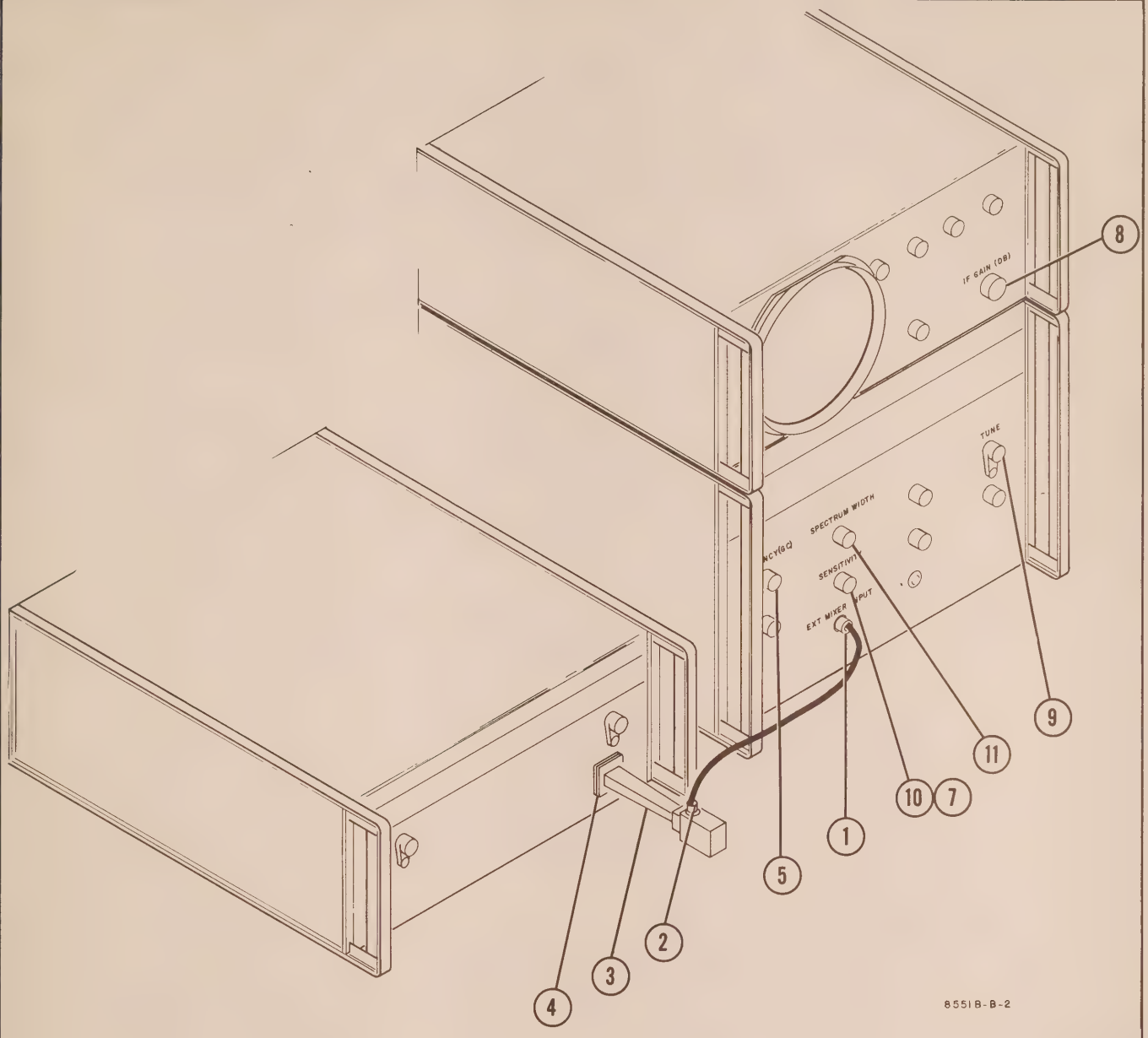
6. If 2-cm shift obtained in step 4 was
   a. to the right (-), read frequency in Gc on upper (-) Frequency Scale;
   b. to the left (+), read frequency in Gc on lower (+) Frequency Scale.

7. Calculate frequency from $F_S = nF_{LO} \pm 2$ Gc
   where n = harmonic number
   F_{LO} = reading on LOCAL OSC FREQ scale obtained in step 3
   Subtract 2 Gc when 2-cm shift is to the right (-), and add when shift is to the left (+).

8. Set SIGNAL IDENTIFIER to OFF.

*Signal identification technique cannot be used on 1.8 - 4.2 range.

Figure 3-5. Determining Frequency of Input, Model 851B/8551B Spectrum Analyzer

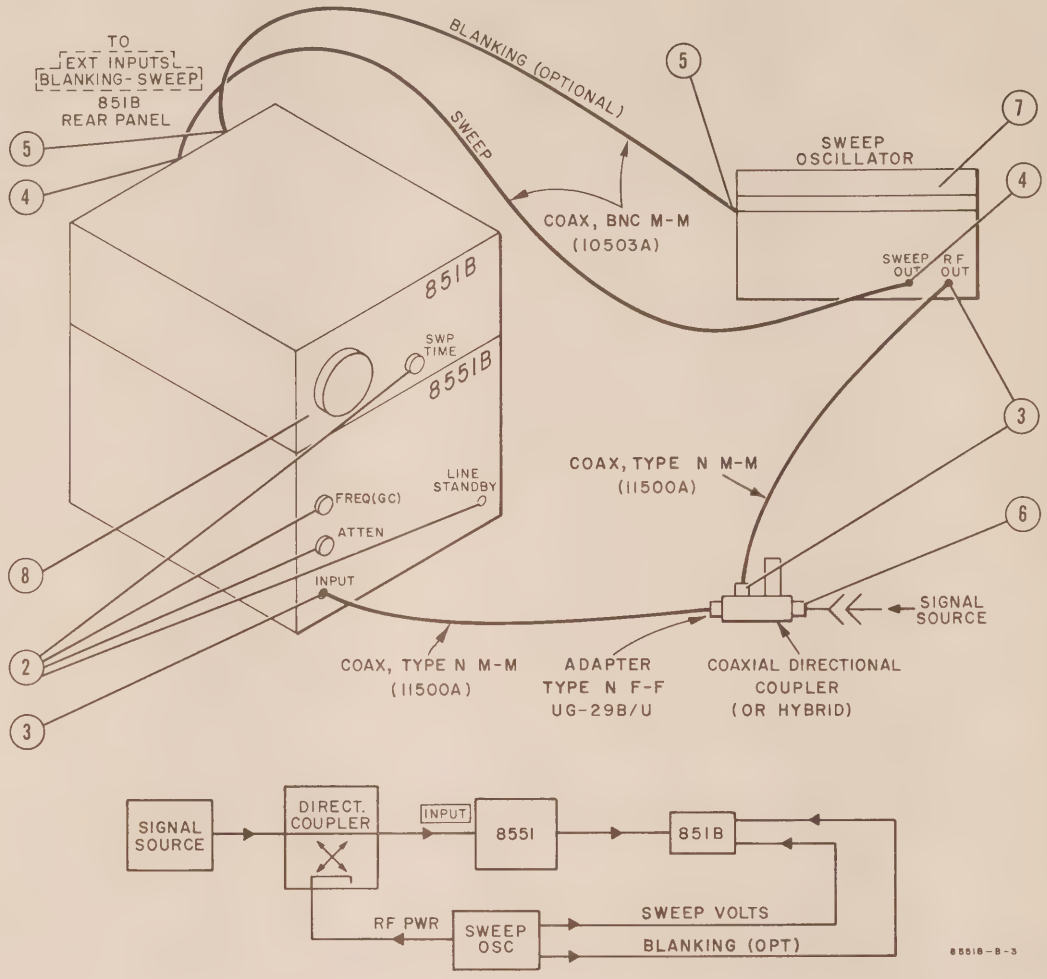


1. Connect cable supplied with waveguide mixer to EXT MIXER INPUT.
2. *First touching edge of male BNC connector on cable to edge of female BNC connector on mixer to discharge cable, connect cable to mixer.
3. If mixer is 11517A, connect adapter to waveguide mixer.
4. Connect adapter or mixer to signal source or measurement system. Mixer range: 12.4 to 40 Gc. For linear operation, adjust signal source for output no greater than that shown in Table 3-2. CAUTION: Signal applied to waveguide mixer should be no greater than 1 mW.

*To avoid damage to mixer diode, it is extremely important to follow this procedure.

5. Set FREQUENCY(GC) to lowest range which covers signal under analysis.
6. When using the EXT MIXER INPUT, ATTENUATOR(DB) is not in the circuit. Except for setting this control, put the analyzer into operation per Figure 3-3.
7. Adjust SENSITIVITY for best signal trace.
8. Set I.F. GAIN(DB) for convenient signal-to-noise ratio.
9. Adjust TUNE to center signal on CRT.
10. Readjust SENSITIVITY for best signal trace.
11. Adjust SPECTRUM WIDTH to obtain best detail in region of interest.

Figure 3-6. Initial Operating Procedure for 12.4-Gc to 40-Gc Input, Model 851B/8551B Spectrum Analyzer



1. Connect 8551B to 851B:
   a. SWITCHED LINE OUTPUT to 851B LINE INPUT.
   b. IF OUTPUT to 851B IF INPUT.
   c. CONTROL to 851B CONTROL.

2. Set: ATTENUATOR(DB). 0
   LINE. . . . . STANDBY
   FREQUENCY(GC) 01-2
   SWEEP TIME . . . . . EXT

3. Connect sweep oscillator RF output to auxiliary arm of coaxial directional coupler (or hybrid); connect directional coupler output to 8551B INPUT. Requirements: LO (sweep oscillator) power to 8551B INPUT: 5 to 10 mW; LO frequency: to provide mixing product of 2 Gc.

4. Connect sweep voltage to EXT INPUT - SWEEP on 851B rear panel. Requirements: 0 to +15V sawtooth voltage concurrent with swept sweep oscillator (LO) power.

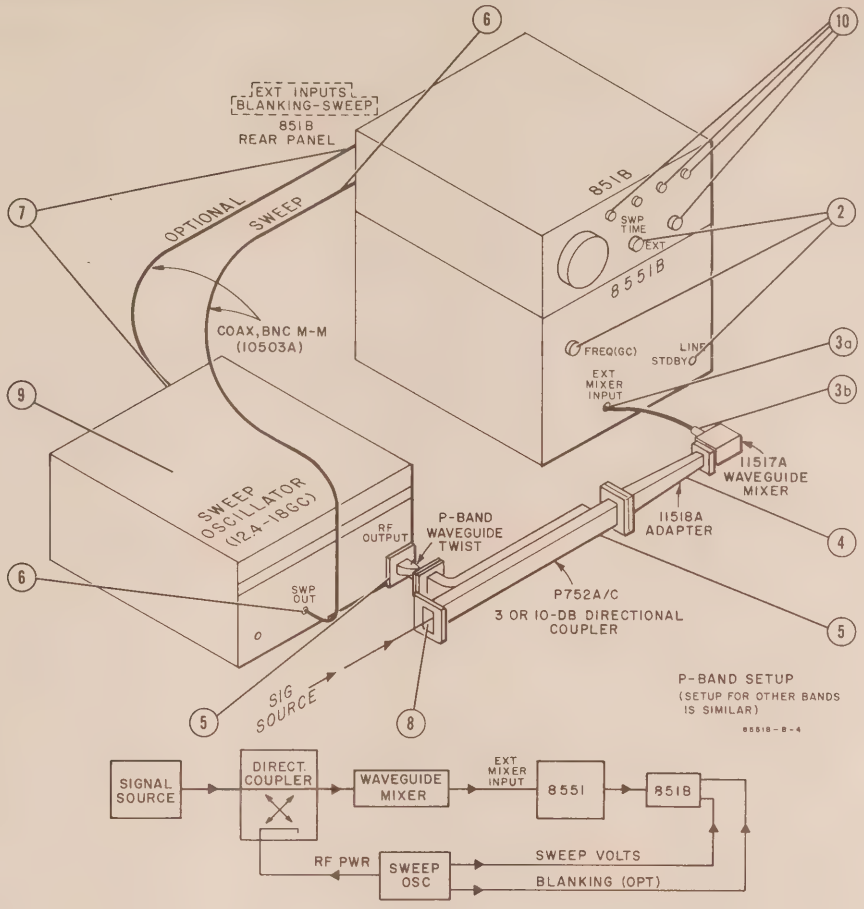
5. If suitable signal is available, connect blanking voltage to EXT INPUT - BLANKING on 851B rear panel. Requirements: -4V pulse compatible with sweep voltage. NOTE: Use of blanking signal is optional.

6. Connect signal source to directional coupler input. Signal power at 8551 INPUT should be no more than a milliwatt. For minimum intermodulation and internally generated spurious signals, keep input at -30 dBm or below.

7. Set sweep oscillator for type of operation, tuning, width of sweep, and sweep rate desired.

8. Set 851B controls for type of display desired. All controls are operative except SYNC and AUTO SELECT position on I. F. BANDWIDTH.

Figure 3-7. Typical Connections and Operating Procedure when Substituting an External Sweep Oscillator for 8551 LO (BWO), Coaxial Ranges



1. Connect 8551B to 851B:
   a. SWITCHED LINE OUTPUT to 851B LINE INPUT.
   b. IF OUTPUT to 851B IF INPUT.
   c. CONTROL to 851B CONTROL.

2. Set: LINE . . . . . STANDBY
   SWEEP TIME . . . . . EXT
   FREQUENCY(GC) 8-18

3. Connect waveguide mixer:
   a. Connect cable supplied with waveguide mixer to EXT MIXER INPUT.
   b. First touching edge of male BNC on cable to edge of female BNC on mixer to discharge cable, connect cable to mixer.

4. If waveguide mixer is the Model 11517A (12.4 - 40 Gc), connect appropriate adapter to waveguide mixer.

5. Connect sweep oscillator RF OUTPUT to auxiliary arm of appropriate waveguide directional coupler; connect directional coupler output to waveguide mixer (or adapter). Requirements at Waveguide Mixer Input - LO (sweep oscillator) power: 11521A - 5 to 10 mW, 11517A - not more than 5 mW; LO frequency: to provide mixing product of 2 Gc.

6. Connect sweep voltage to EXT INPUT - SWEEP on 851B rear panel. Requirements: 0 to ±15V sawtooth voltage concurrent with swept sweep oscillator (LO) power.

7. If suitable signal is available, connect blanking voltage to EXT INPUT - BLANKING on 851B rear panel. Requirements: -4V pulse compatible with sweep voltage. NOTE: Use of blanking signal is optional.

8. Connect signal source to directional coupler input. Signal power at waveguide mixer input should be no more than a milliwatt. For minimum intermodulation and spurious signals, keep input at -30 dBm or below.

9. Set sweep oscillator for type of operation, tuning, width of sweep, and sweep rate desired.

10. Set 851B controls for type of display desired. All controls are operative except SYNC and the AUTO SELECT position on I. F. BANDWIDTH.

Figure 3-8. Typical Connections and Operating Procedure when Substituting an External Sweep Oscillator for 8551B LO (BWO), Waveguide Ranges

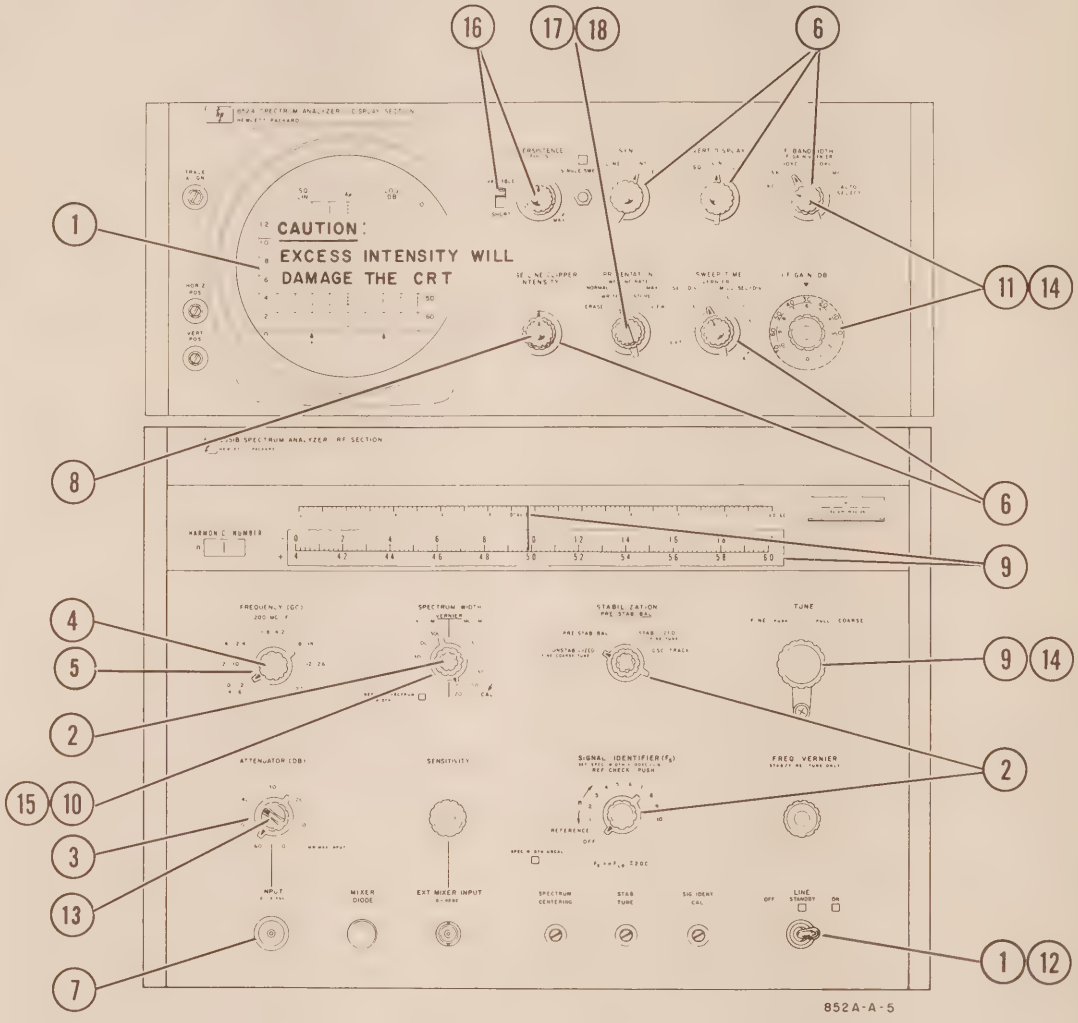


Figure 3-9. Initial Operating Procedure for 10.1 Mc to 12.4-Gc Inputs Model 852A/8551B Spectrum Analyzer (1 of 2)

1. LINE: Set to STANDBY; light should glow, fan turn. After about 10-seconds, base line appears on CRT. CAUTION: Before setting LINE to ON (step 12), be sure fan is turning; BWO can be damaged if fan is not operating.

2. Set: SIGNAL IDENTIFIER. . . . . OFF
   FREQUENCY TUNING. . . . . COARSE
   SPECTRUM WIDTH VERNIER. . . CAL

3. ATTENUATOR (dB): Set to 60.

4. Set range switch, FREQUENCY (GC).

5. 1st IF:

   a. 200 MC if FREQUENCY (GC) is at 1.8-4.2.

   b. 2 GC for all other inputs.

6. Set: BASELINE CLIPPER. . . . . max CCW
   SYNC. . . . . LINE
   IF BANDWIDTH. . . . . AUTO SELECT
   VERT DISPLAY. . . LINE, LOG, or SQ
   SWEEP TIME. . . . . 3 MILLISEC/DIV
   VERNIER . . . . . .CAL
   PERSISTENCE . . . . . NORMAL

7. Connect signal under investigation; range 10.1 Mc to 12.4 Gc.

   CAUTION
   Input must not exceed 1 watt average with ATTEN (dB) set at 60; see 8551 RF Section Manual.

8. INTENSITY: Set at Mid-range.

9. If input frequency is unknown, set TUNE to 3 on LOCAL OSC FREQ scale; if known, set TUNE for frequency scale reading near that of input signal.

10. Set SPECTRUM WIDTH for 200 MC/CM.

11. Set IF GAIN (dB) at 70 and IF VERNIER max CCW.

12. Set LINE to ON; indicator light will glow. When TUNE is at 2 GC, large signal will appear; this is the BWO signal.

13. ATTENUATOR (dB): Adjust to bring signal on CRT.

    CAUTION
    Attenuator must be set to reduce input signal to 1 mW or less.

14. Set IF GAIN for convenient signal-to-noise ratio, and adjust TUNE to center signal on CRT.

15. Adjust SPECTRUM WIDTH for best detail in region of interest.

16. PERSISTENCE. Adjusted along with INTENSITY for bright, persisting display without bloom. At slow sweep speeds, long persistence "paints" spectrum signature and reduces flicker.

17. PRESENTATION: Set to WRITE. To erase a variable persistence display, turn to ERASE and then release. In the STORE position, storage time is one hour or more. In the VIEW position, storage time is 1 minute or more.

18. WRITING RATE: Use in NORMAL position unless signals have fast rise times.

Figure 3-9. Initial Operating Procedure for 10.1 Mc to 12.4-Gc Inputs
Model 852A/8551B Spectrum Analyzer (2 of 2)

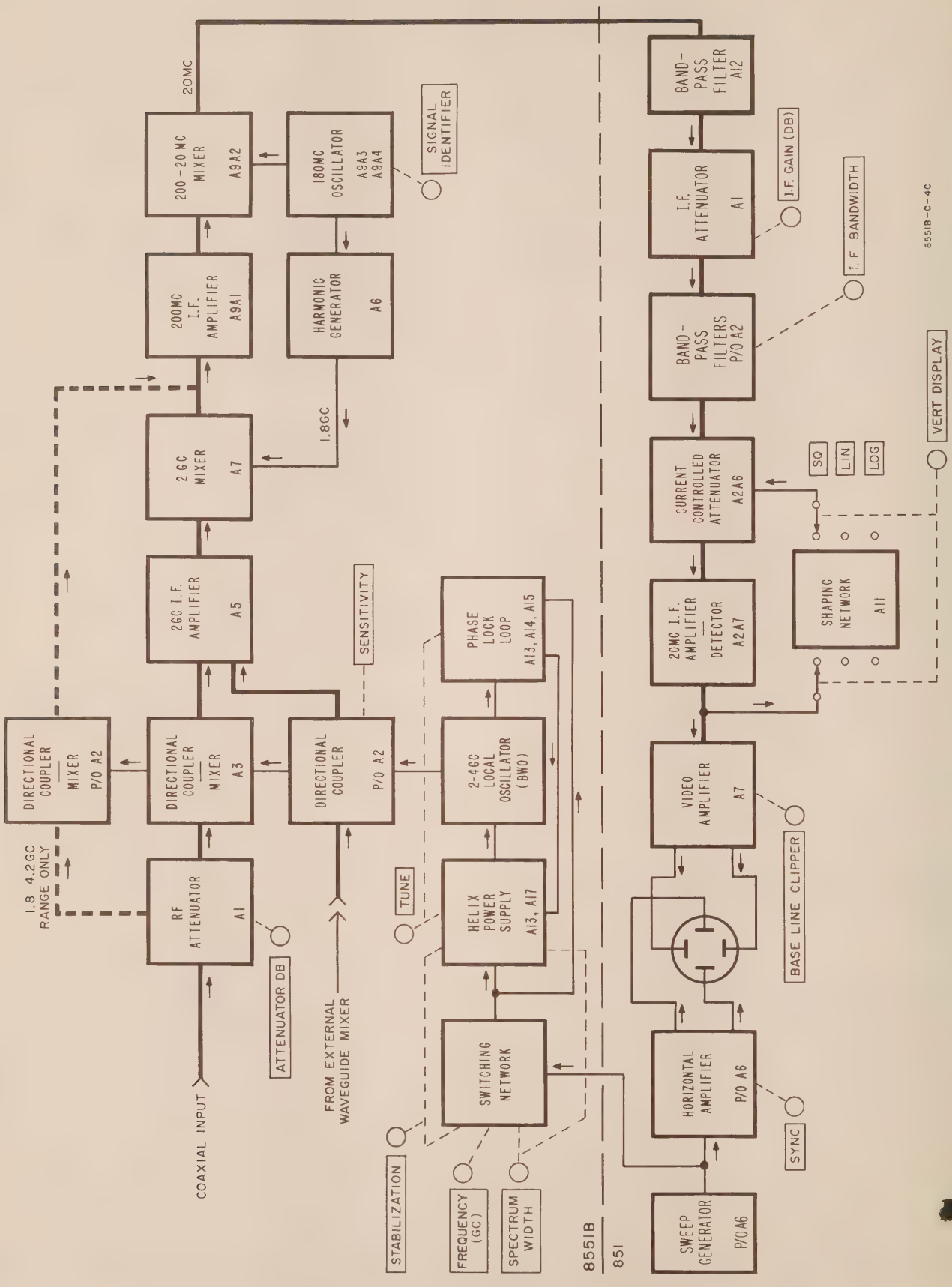


Figure 4-1. Overall Block Diagram

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. The 8551B is a triple conversion superheterodyne receiver with a swept first local oscillator. Input signals are converted first to 2 Gc, then to 200 Mc, and finally to the output IF of 20 Mc to be applied to the 851 Spectrum Analyzer Display Section. The swept local oscillator permits the spectrum analyzer to present a continuous CRT display of signal amplitude versus frequency.

4-3. OVERALL DESCRIPTION.

4-4. A block diagram of the spectrum analyzer including the 851 Display unit is shown in Figure 4-1. As shown in the block diagram, the sweep signal that drives the BWO first local oscillator is developed in the display section. This sweep signal is applied to a switching network that attenuates the sweep in accordance with the frequency range and spectrum width selected. The helix power supply reshapes the linear sweep to match the exponential helix-voltage-versus-frequency characteristics of the BWO. The sweep is also applied to the phase-lock loop. The output of the helix power supply is also affected by the TUNE control, which sets the center frequency about which the BWO sweeps. The output of the BWO is applied to three series-connected directional couplers, which couple the energy to the various mixers.

4-5. Input signals are applied either to the front panel coaxial input or to external waveguide mixers. Signals applied to the coax input pass through the RF attenuator, a 0 to 60 dB attenuator with 10-dB steps, and then through a fixed 3-dB attenuator to the mixer in assembly A3. The output of this mixer is applied to the 2-Gc IF amplifier, so any input signal differing by ±2 Gc from the BWO signal frequency or its harmonics will cause a mixer output at 2 Gc. This 2-Gc signal is amplified and applied to the second mixer in A7, where it is mixed with a 1.8-Gc signal and converted to 200 Mc. The 1.8-Gc signal is the result of a times 10 multiplication of the 180-Mc oscillator output by harmonic generator A6. The 200-Mc IF amplifier amplifies the output of Mixer A7 and applies the resulting signal to Mixer A9A2 which mixes the 200-Mc and 180-Mc signals for a final output IF of 20 Mc.

4-6. The circuit through Coaxial Mixer Assembly A3 and 2GC IF Amplifier A5, briefly described in Paragraph 4-5, is used for all signals applied to the coaxial input except those that are very close to 2 Gc. Signals of 2 Gc ±10 Mc pass through Mixer A3 into 2GC IF Amplifier A5. (Lifting of entire base line on display CRT, indicates that the displayed signal was not mixed with BWO signal. Unmixed signals reach the 2 Gc IF Amplifier A5 at a higher level than signals that are the product of mixing the input and BWO frequencies.) To analyze signals at or near 2 Gc, therefore, the analyzer provides a mixing system that bypasses 2GC IF Amplifier A5 and the rest of the 2-Gc system; required connections are set up when FREQUENCY(GC) is set to 1.8 - 4.2. Switching between the two mixing systems is accomplished by two coaxial switches (not shown in Figure 4-1):

a. Coaxial Switch A22K1 disconnects the coaxial input from Mixer A3 and connects the input to Mixer A2 where incoming signals are mixed with BWO frequencies.

b. Coaxial Switch A8K1 disconnects the 2-Gc system from 200MC IF Amplifier A9A1, and connects the output of Mixer A2 directly to the 200MC IF Amplifier.

4-7. Thus any input signal differing from the BWO frequency by ±200 Mc will result in a 20-Mc output from the 8551 and a display on the 851 CRT. With this arrangement of the RF input circuits, even though the first IF is reduced to 200 Mc, the input signal can be mixed with the full 2- to 4-Gc range of BWO frequencies. However, since the first IF is 200 Mc, image separation is only 400 Mc. Maximum spectrum width, without an overlap of images, is less than 400 Mc. However, sensitivity on the 1.8 - 4.2 range is -100 dBm as against a sensitivity of -90 dBm on the 2.4- to 4.1-Gc range where second harmonic mixing must be used.

4-8. External waveguide mixers are used to observe signals in waveguide systems. These mixers are connected to the 8551B through a flexible coaxial cable that carries the BWO signal to the mixer and the output of the mixer back to the 8551B. A selective filter separates the two signals within assembly A2 of the 8551B. Operation using the waveguide input system is the same as that explained above for the coaxial input system using the 2-Gc IF except for the remote location of the waveguide mixers and the SENSITIVITY control, which applies a variable dc bias to the waveguide mixers to optimize sensitivity. A coaxial switch assembly, A4K1, connects the waveguide input system to the 2-Gc IF amplifier and simultaneously disconnects the coaxial mixer when the FREQUENCY(GC) switch is set to one of the top three ranges.

4-9. DETAILED DESCRIPTION.

4-10. Figures 4-2 through 4-10 describe the individual circuits of the 8551B in detail. Paragraphs 4-11 through 4-25 provide additional information on the phase-lock system, switching logic, and signal identifier.

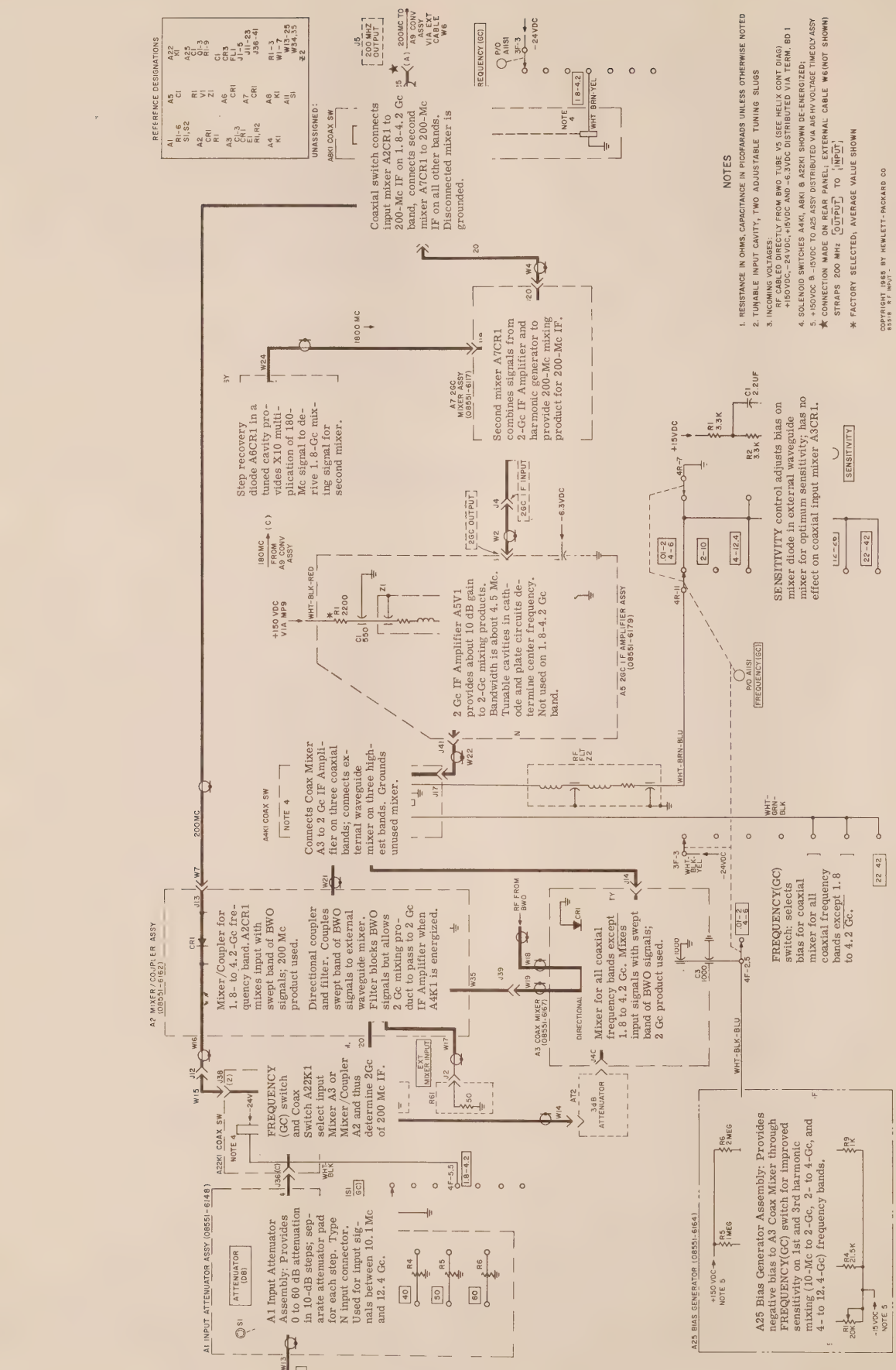


Figure 4-2. RF Input Circuits (sheet 1 of 2)

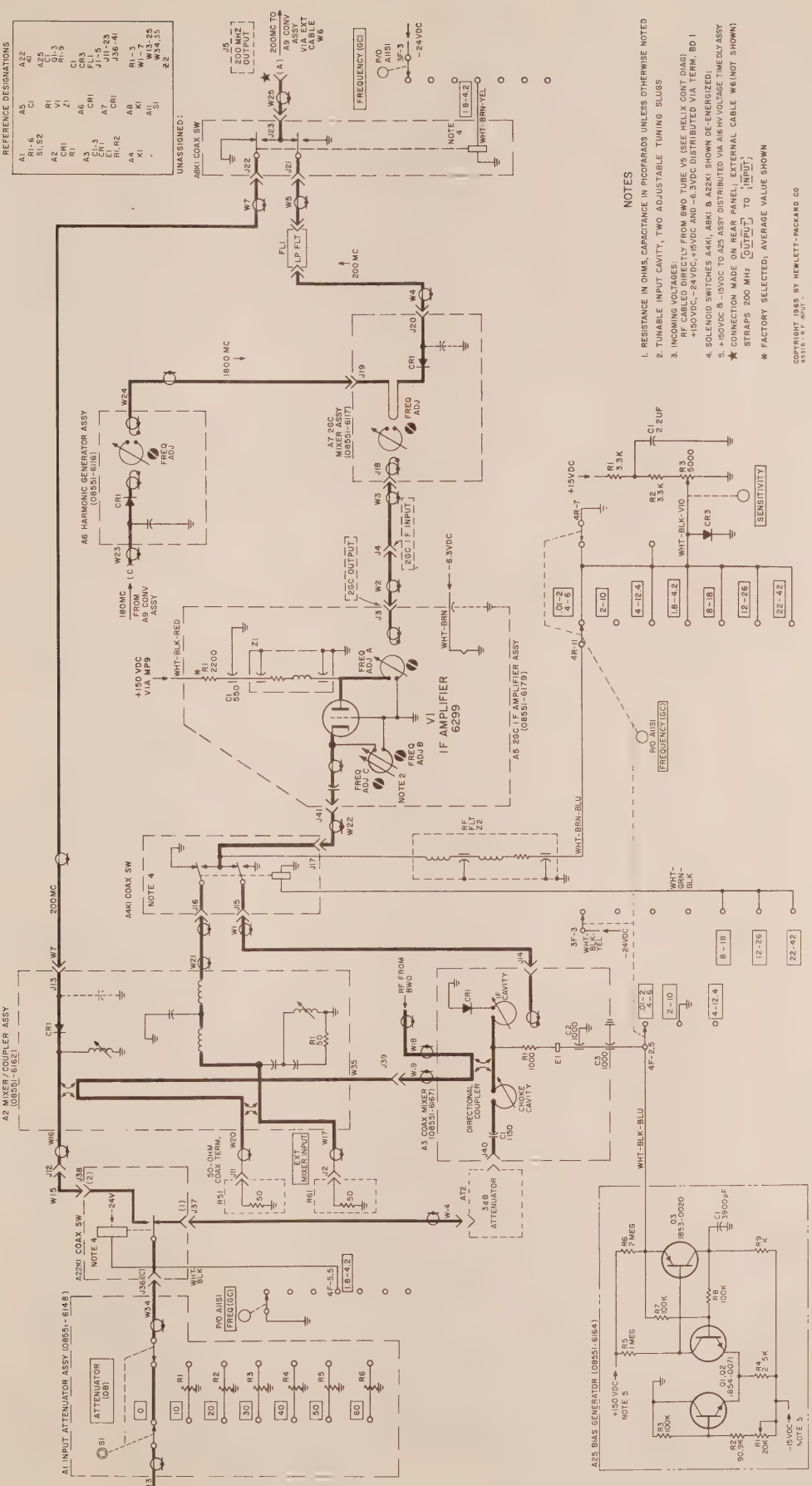


Figure 4-2. RF Input Circuits (sheet 2 of 2)

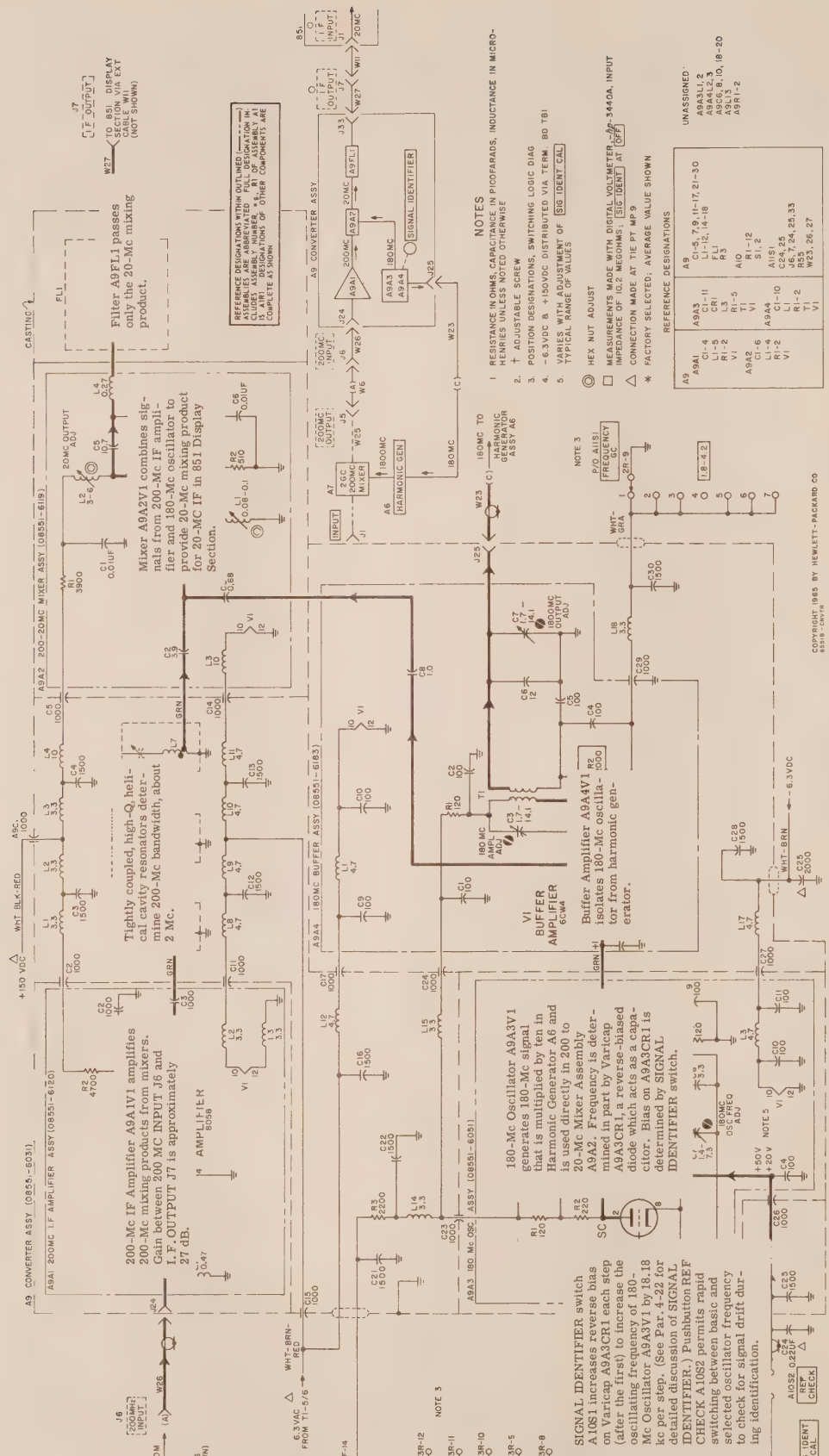


Figure 4-3. Converter Circuits (sheet 1 of 2)

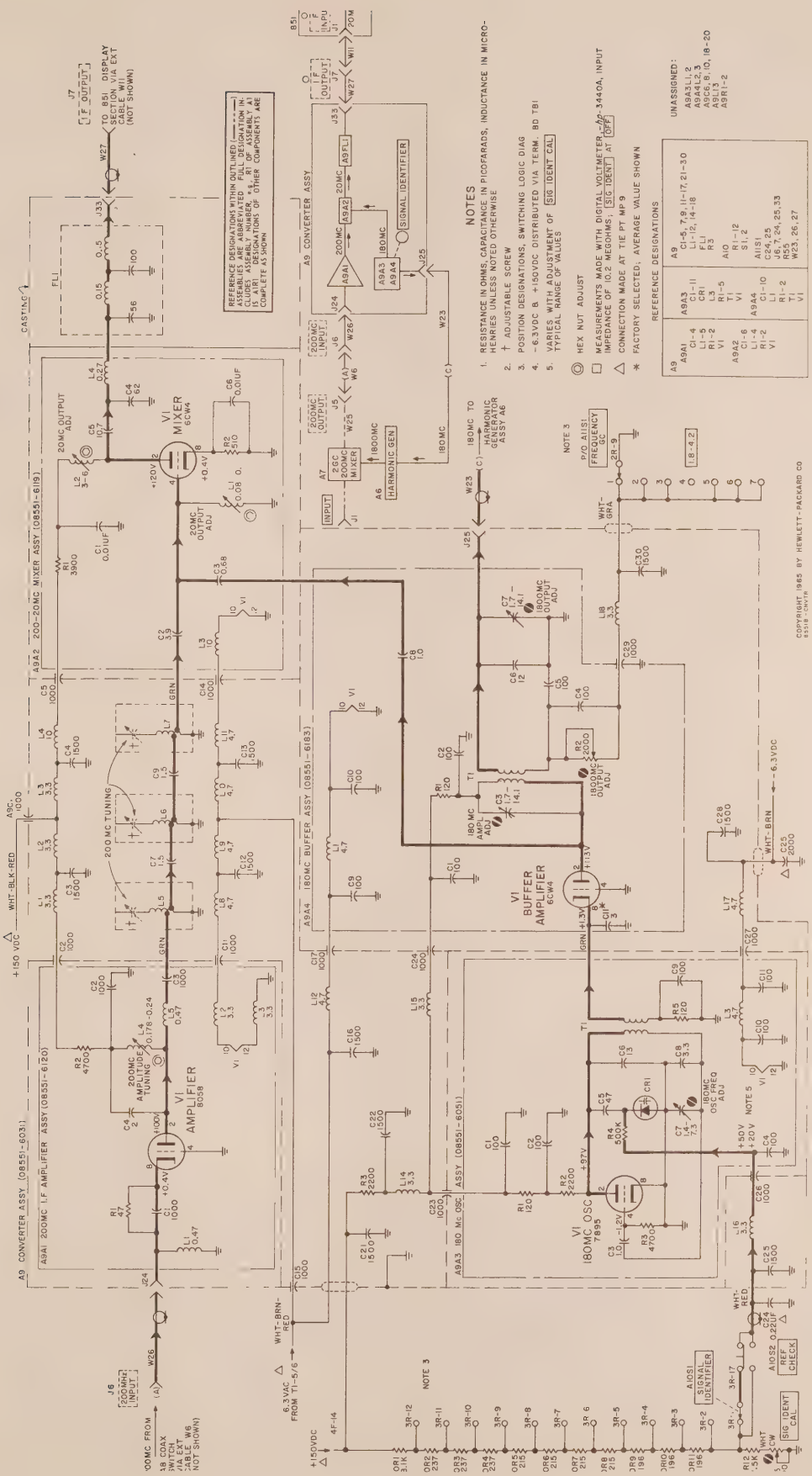


Figure 4-3. Converter Circuits (sheet 2 of 2)

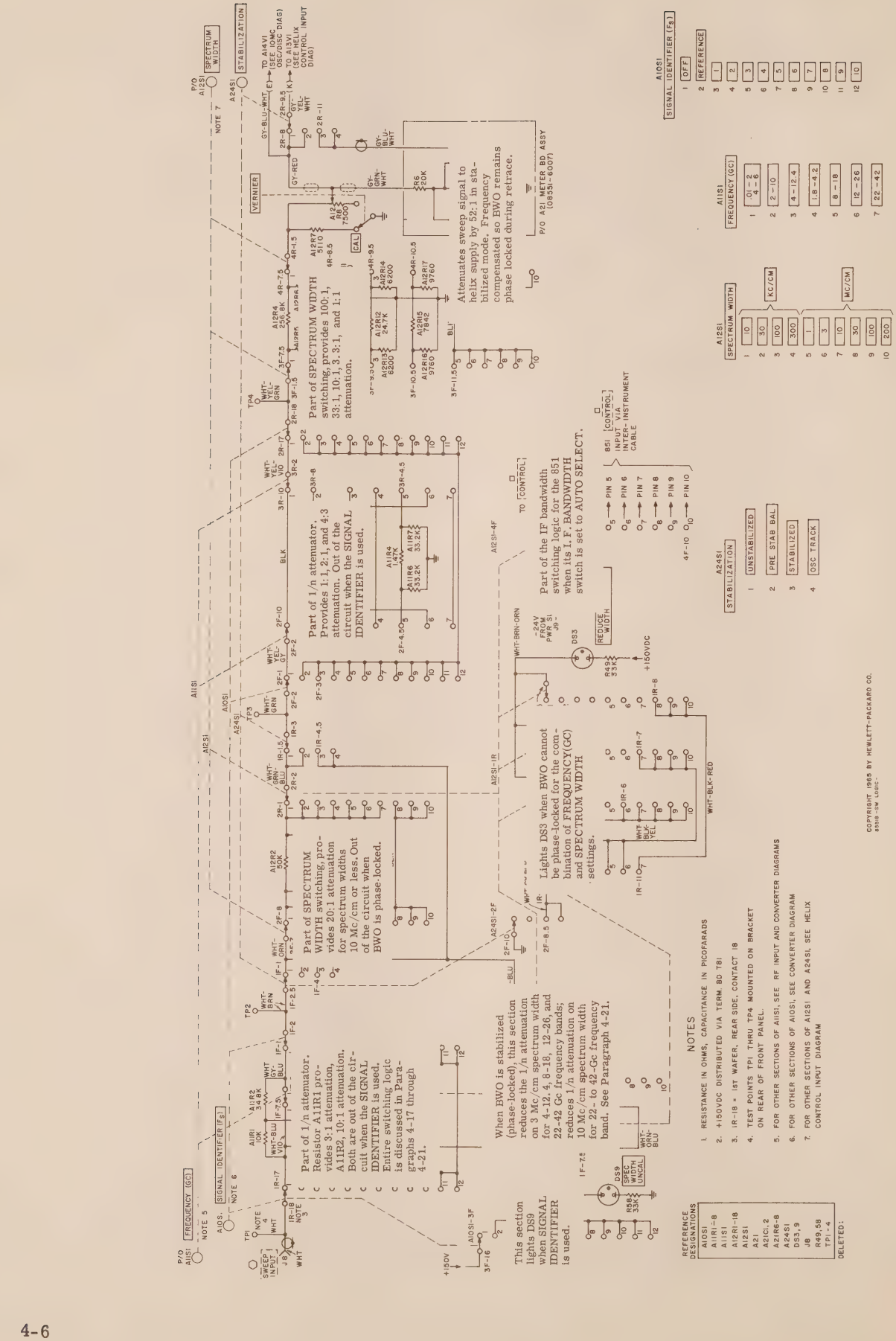


Figure 4-4. Switching Logic (sheet 1 of 2)

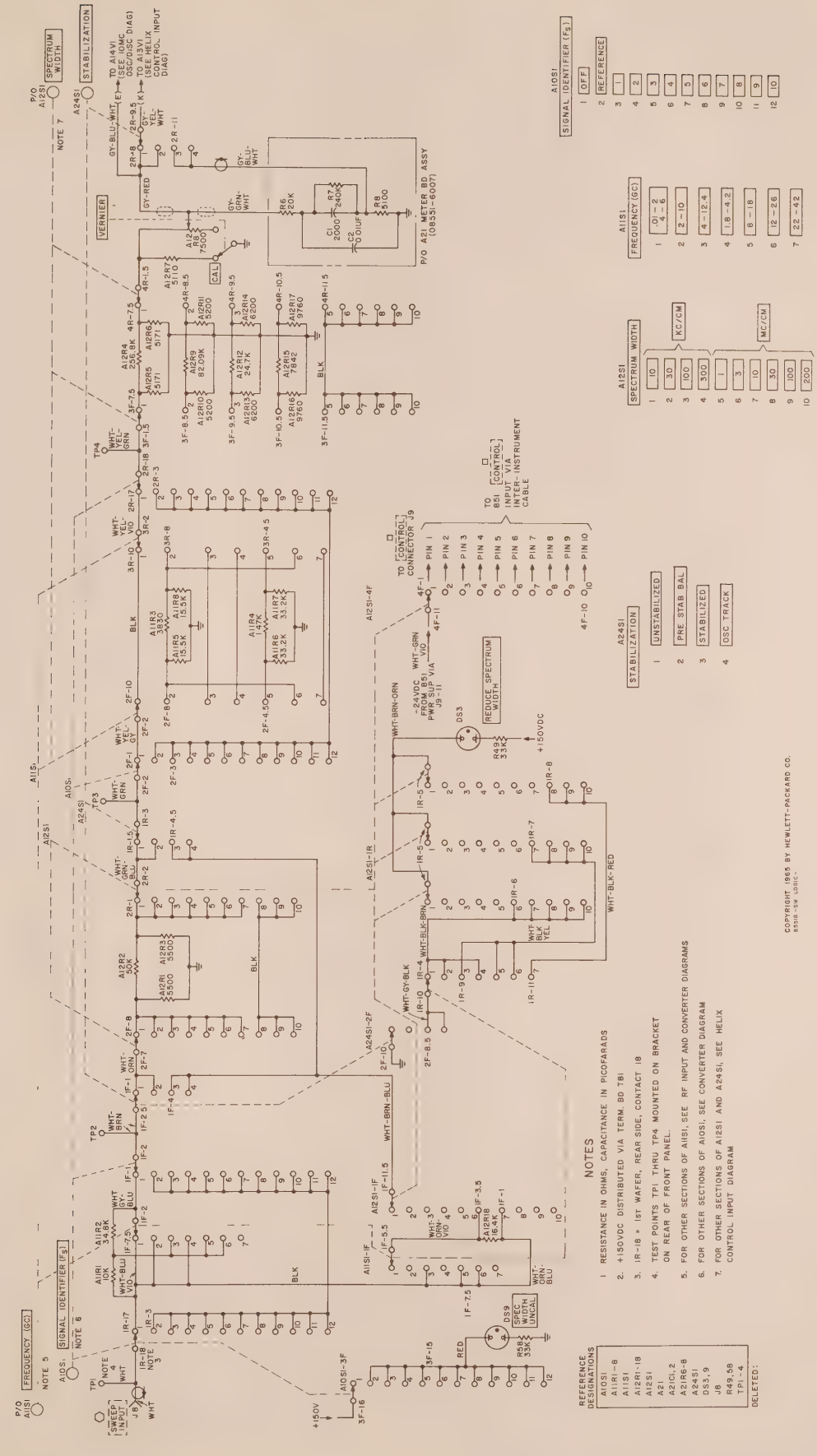


Figure 4-4. Switching Logic (sheet 2 of 2)

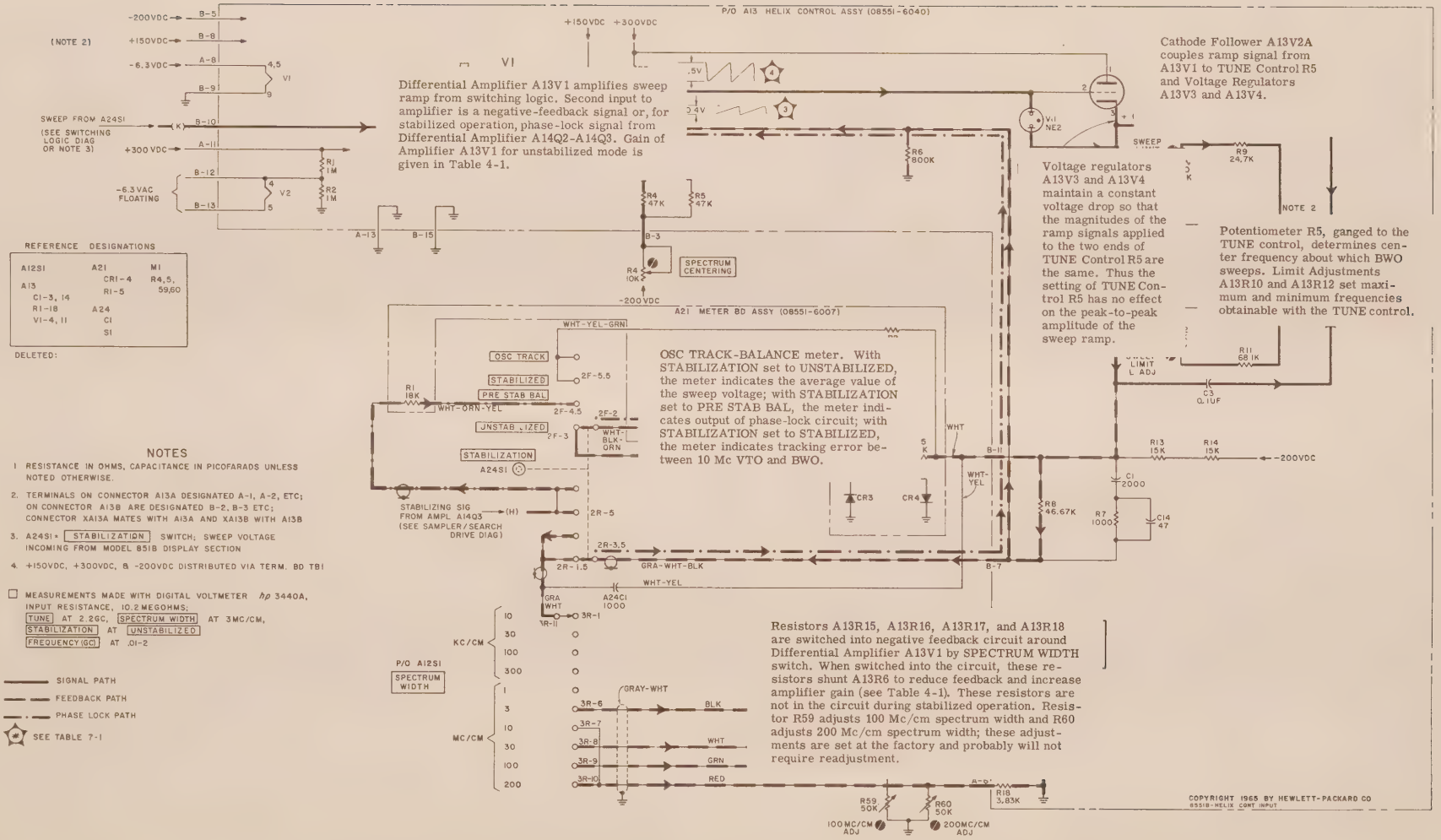


Figure 4-5. Helix Control (Power Supply) Input (sheet 1 of 2)

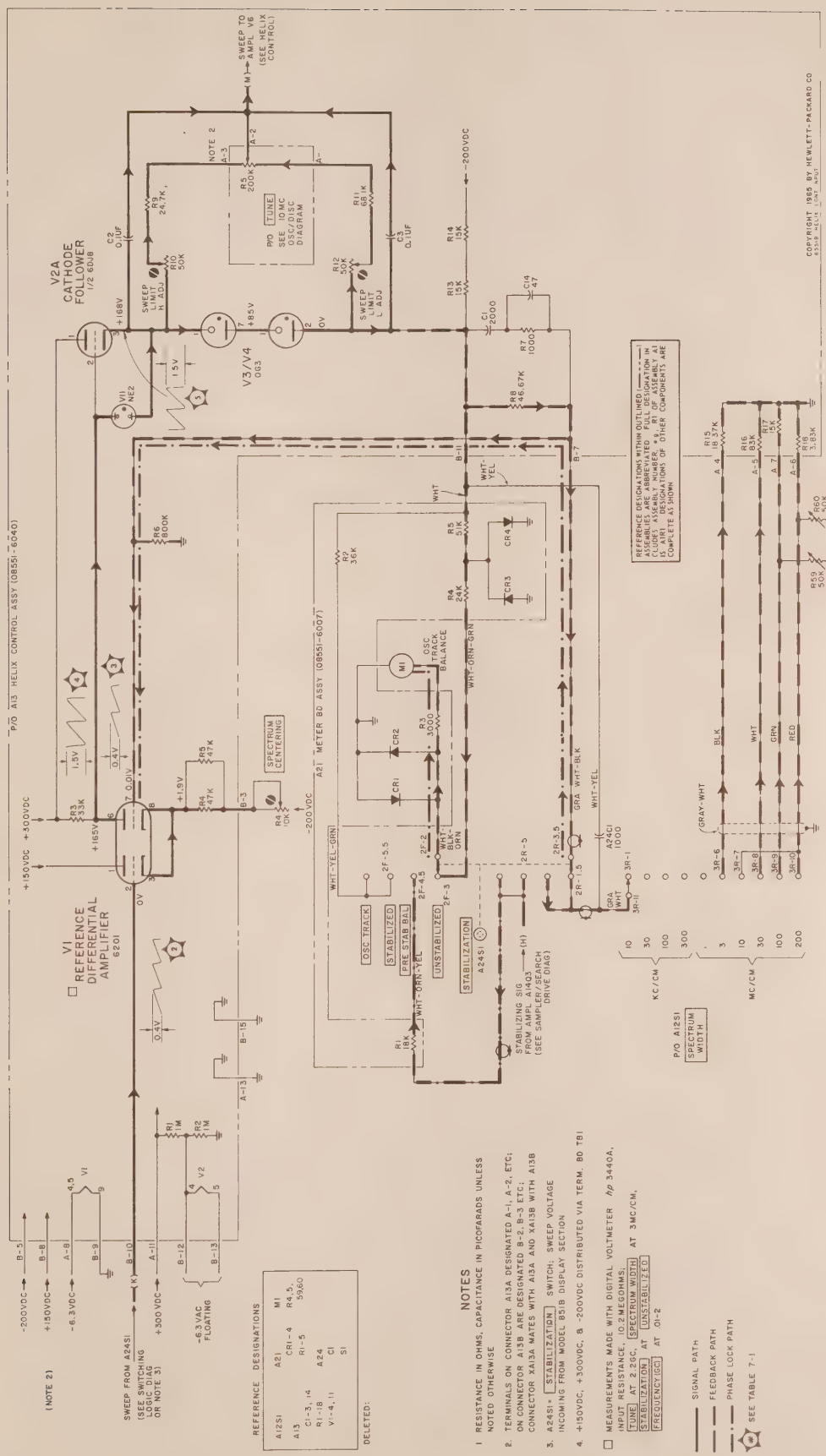


Figure 4-5. Helix Control (Power Supply) Input (sheet 2 of 2)

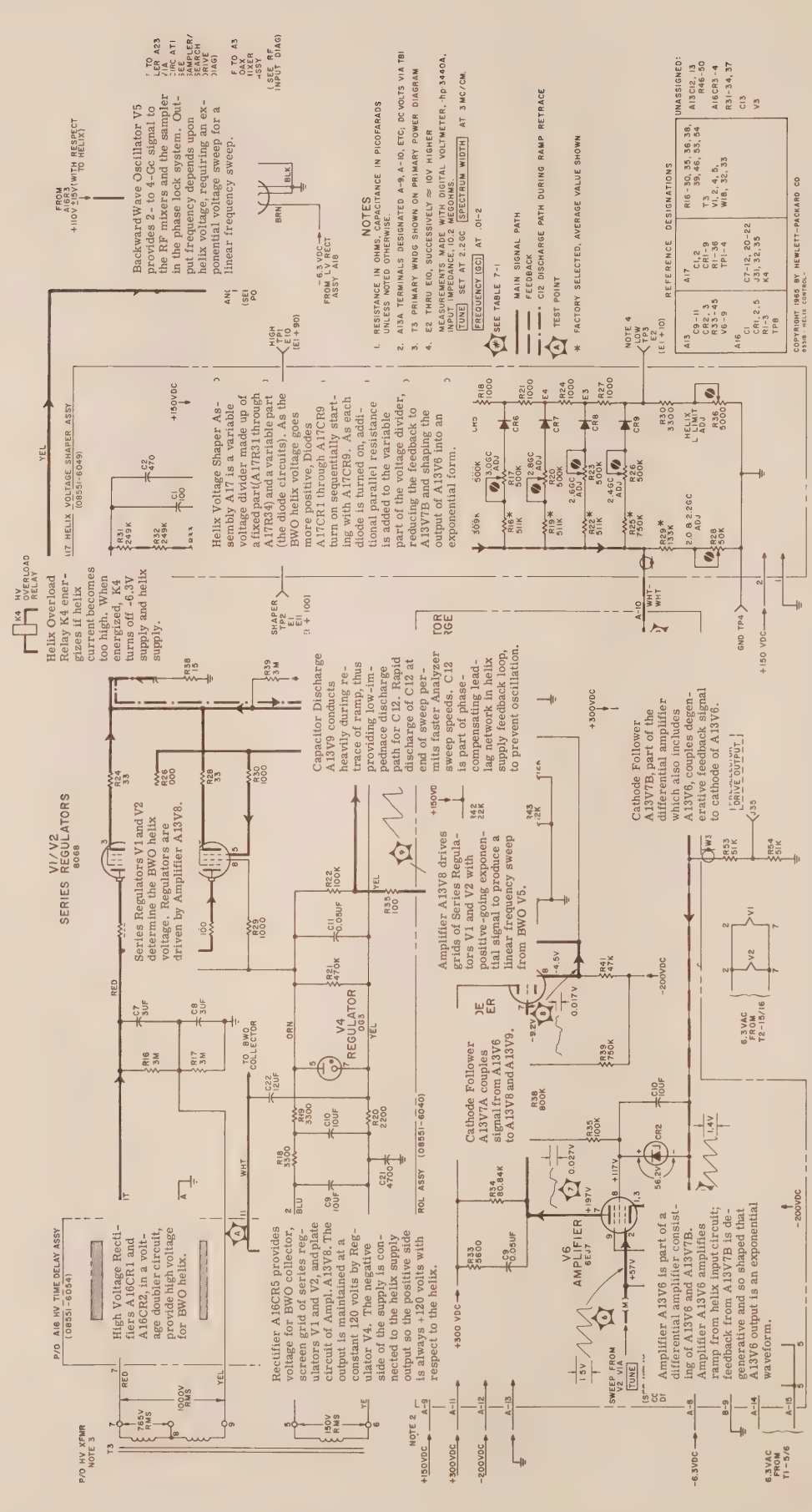


Figure 4-6. Helix Control (Power Supply) (sheet 1 of 2)

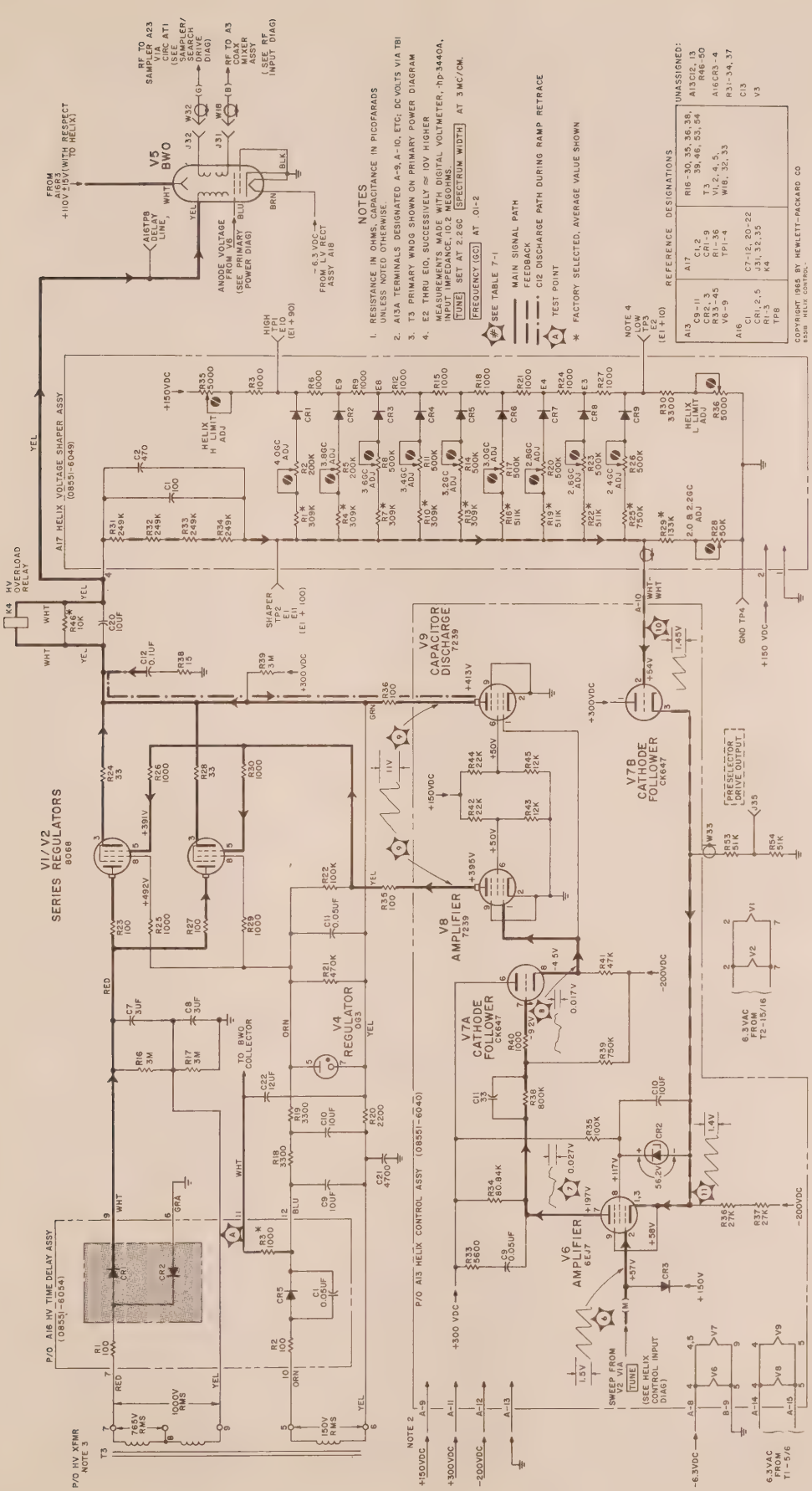


Figure 4-6. Helix Control (Power Supply) (sheet 2 of 2)

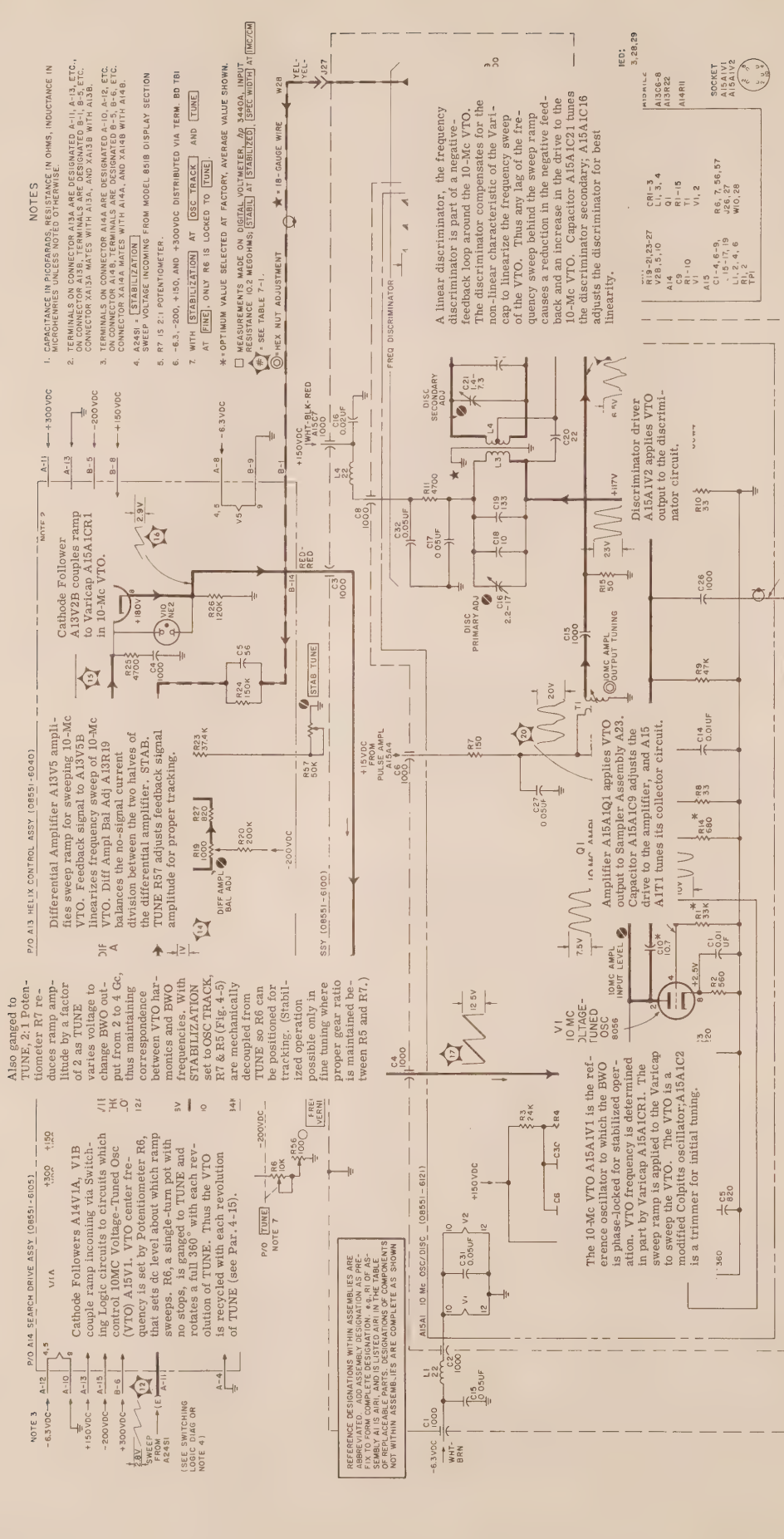


Figure 4-7. Reference Oscillator/Discriminator (sheet 1 of 2)

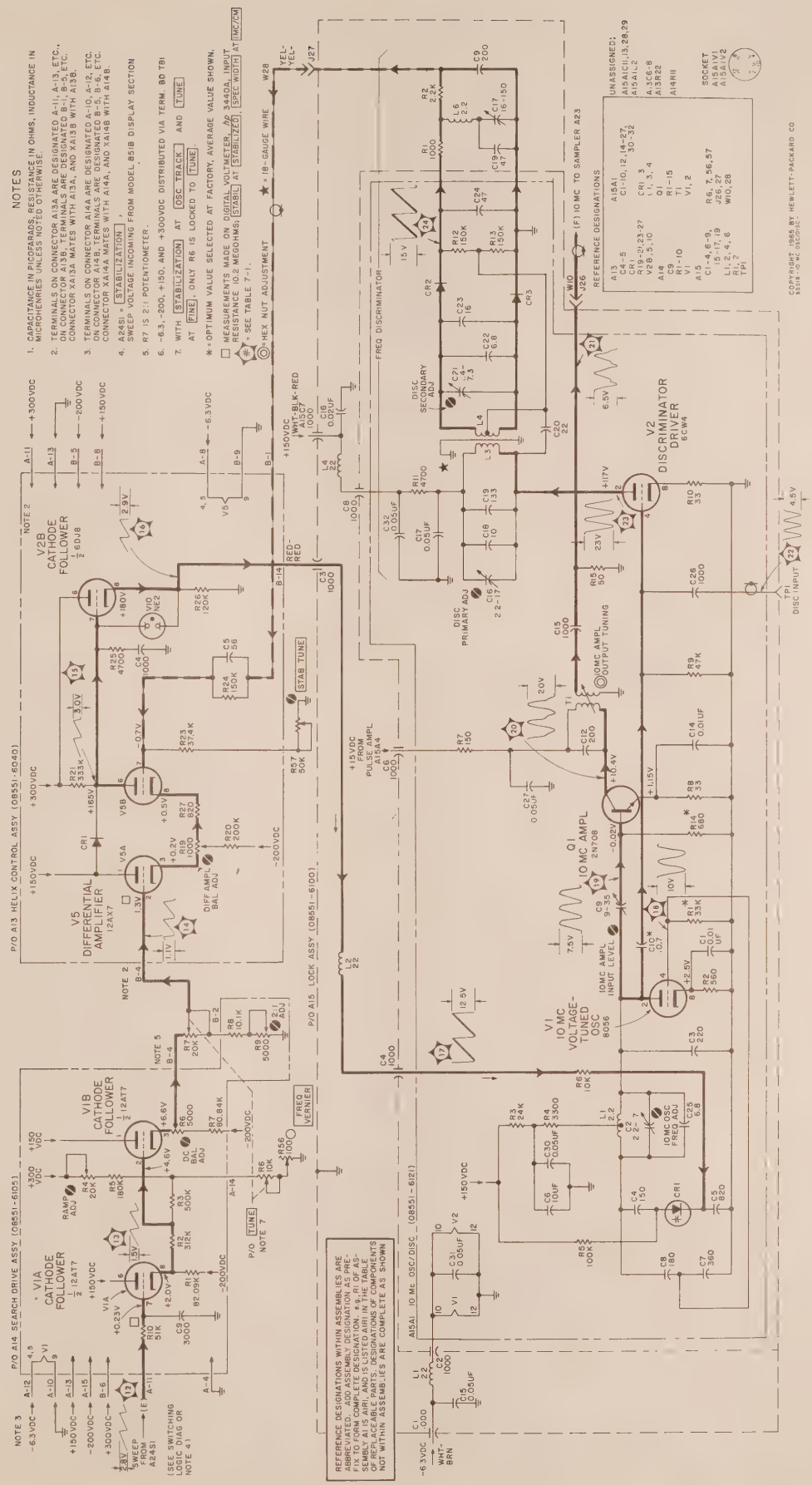


Figure 4-7. Reference Oscillator/Discriminator (sheet 2 of 2)

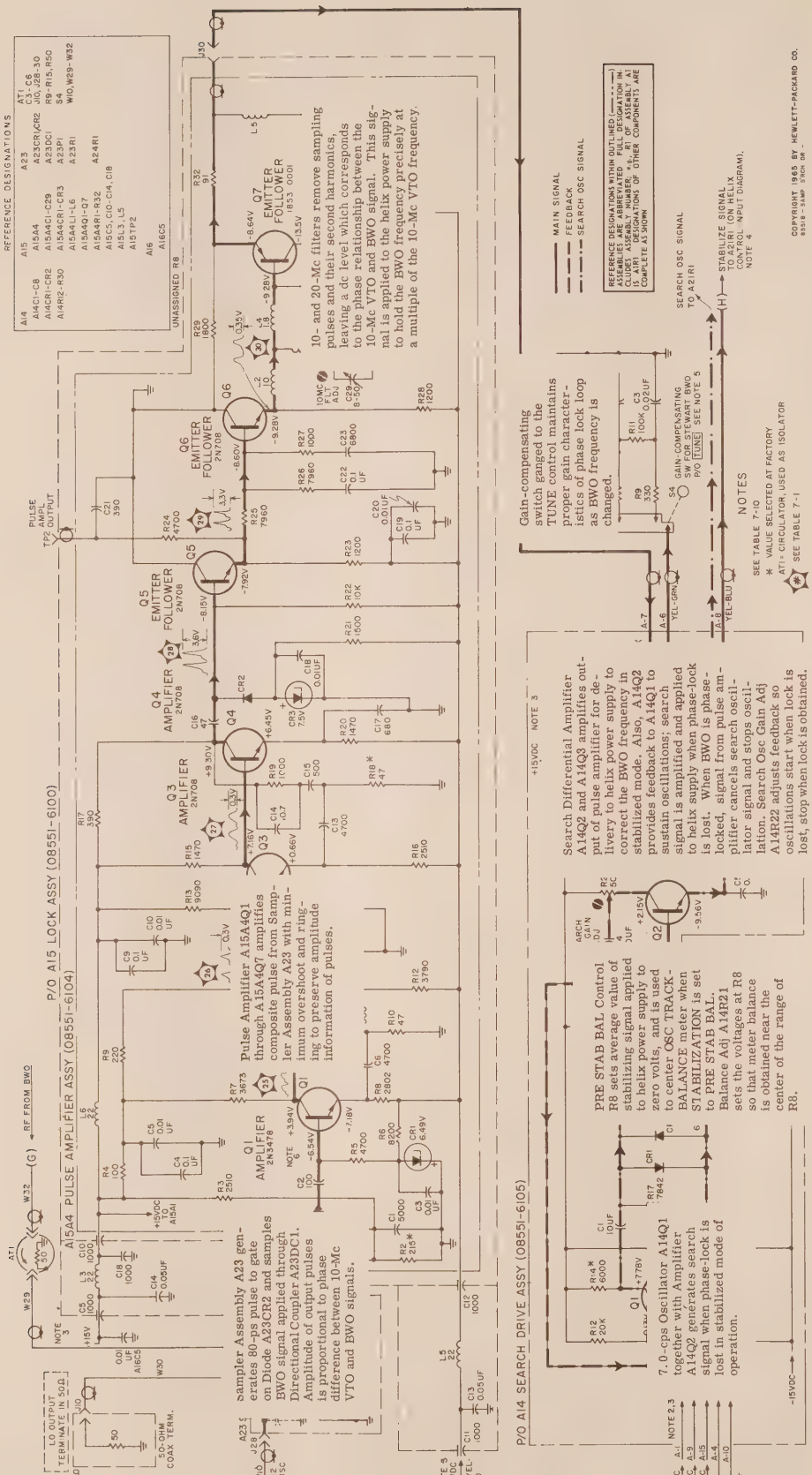


Figure 4-8. Sampler/Search Oscillator Circuits (sheet 1 of 2)

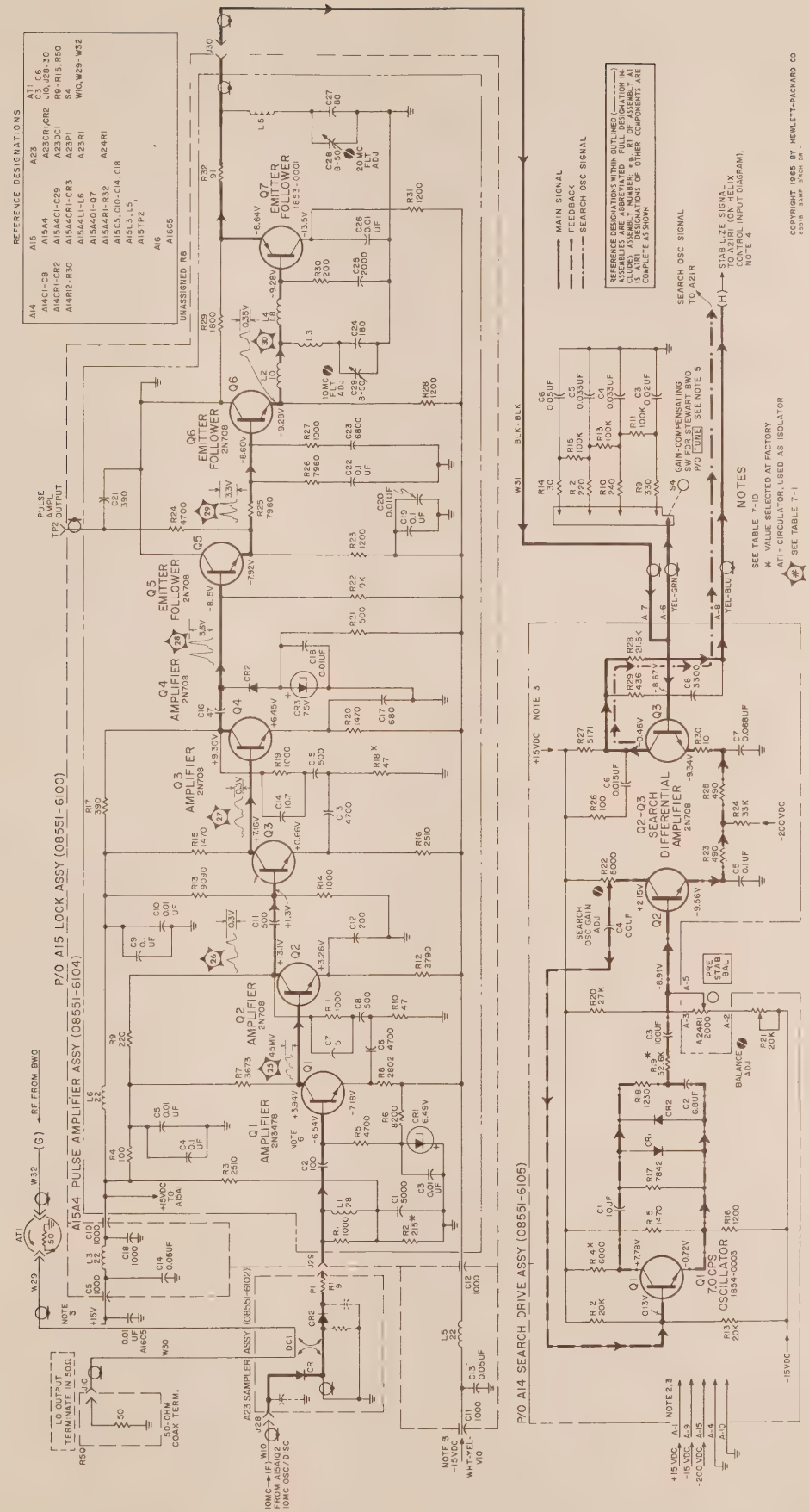


Figure 4-8. Sampler/Search Oscillator Circuits (sheet 2 of 2)

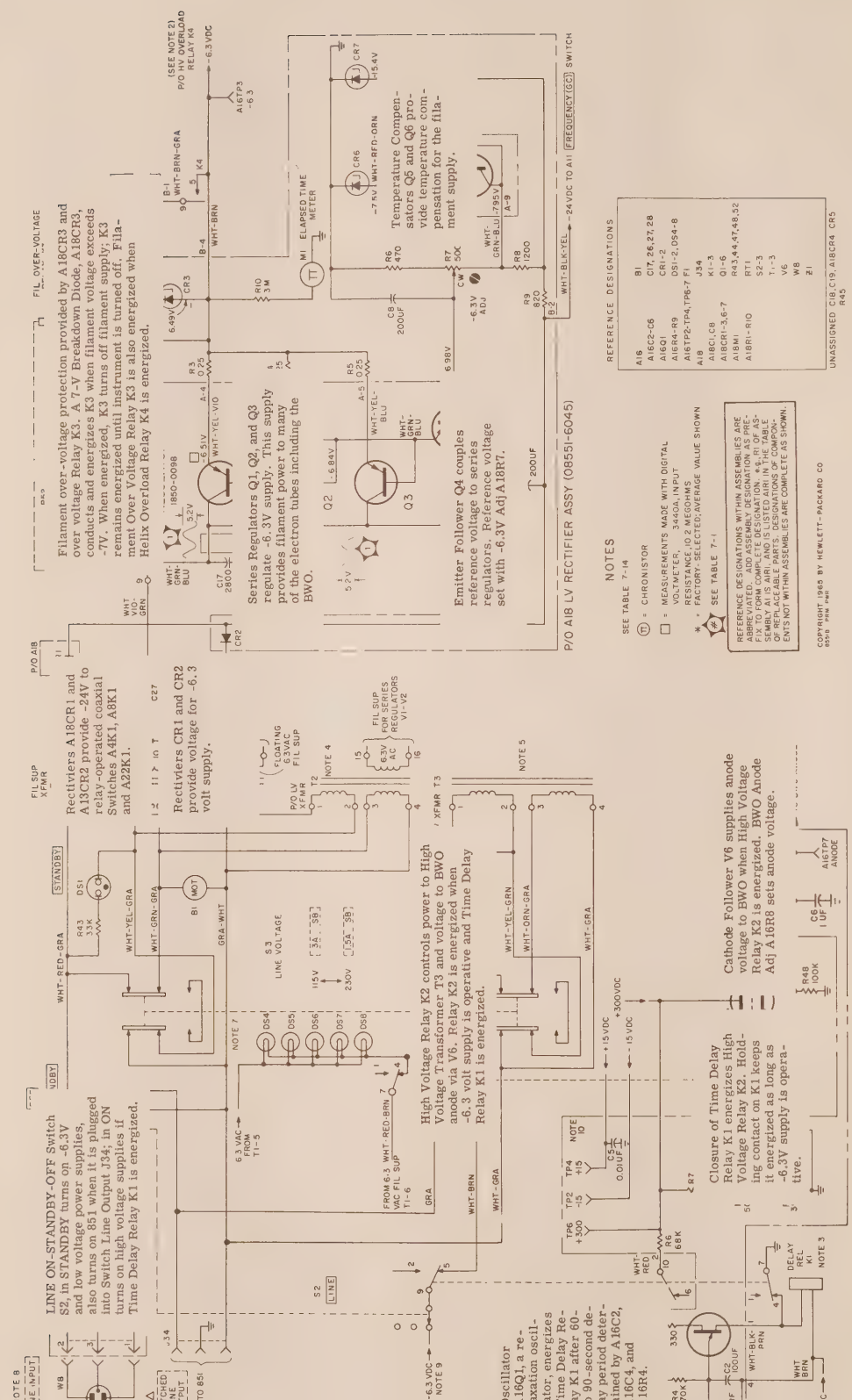


Figure 4-9. Primary Power Circuits (sheet 1 of 2)

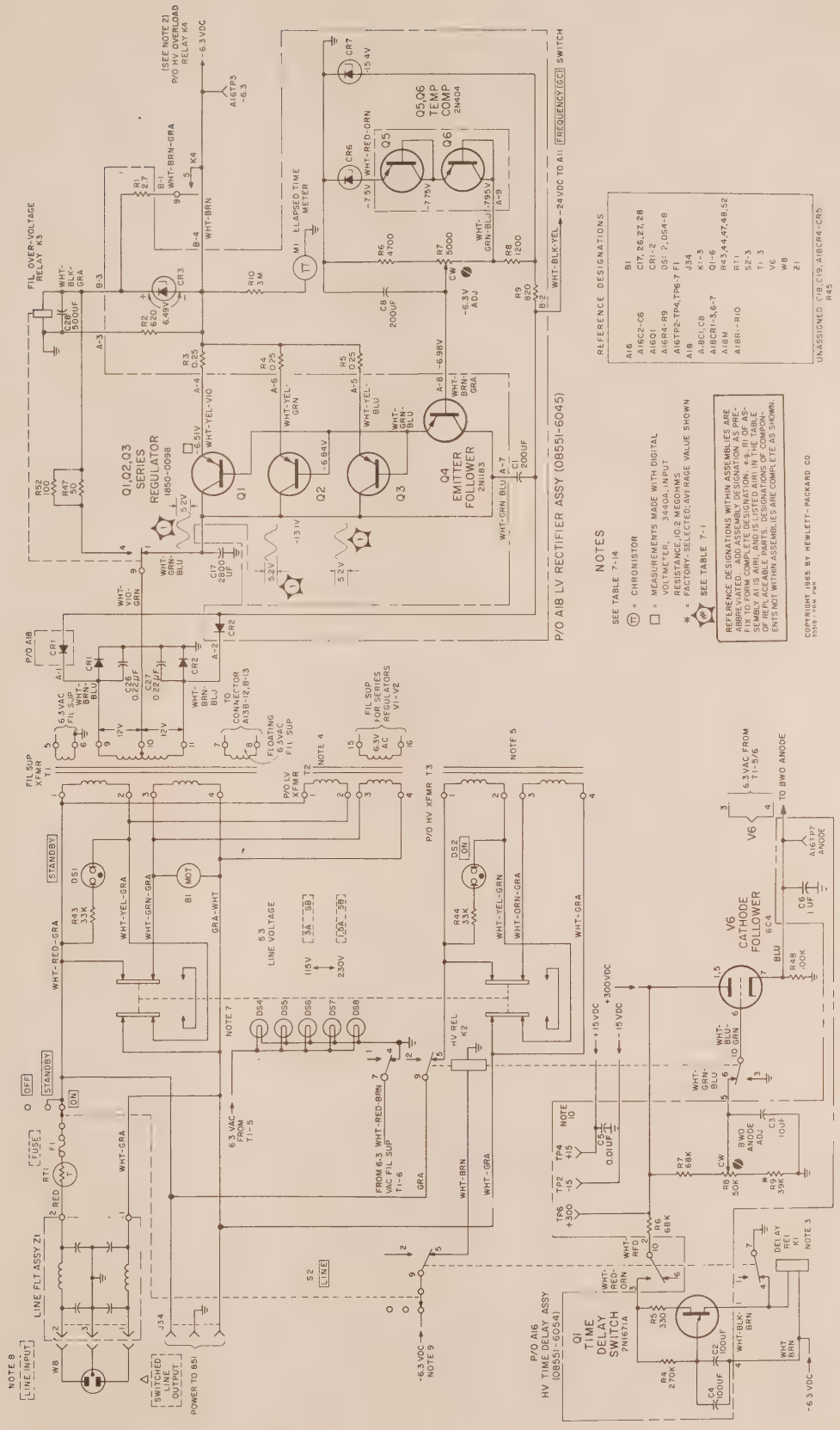


Figure 4-9. Primary Power Circuits (sheet 2 of 2)

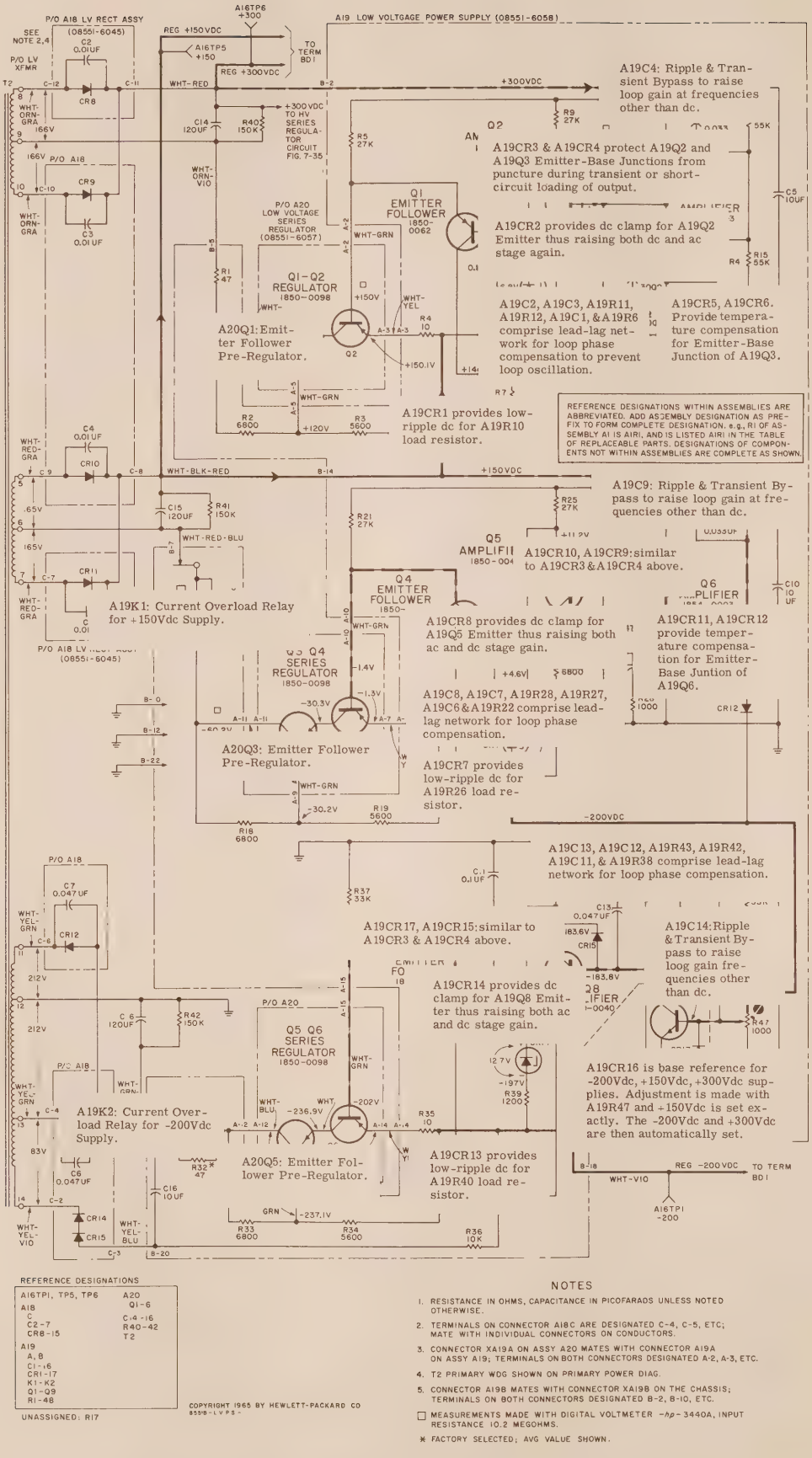


Figure 4-10. Low Voltage Power Supplies (sheet 1 of 2)

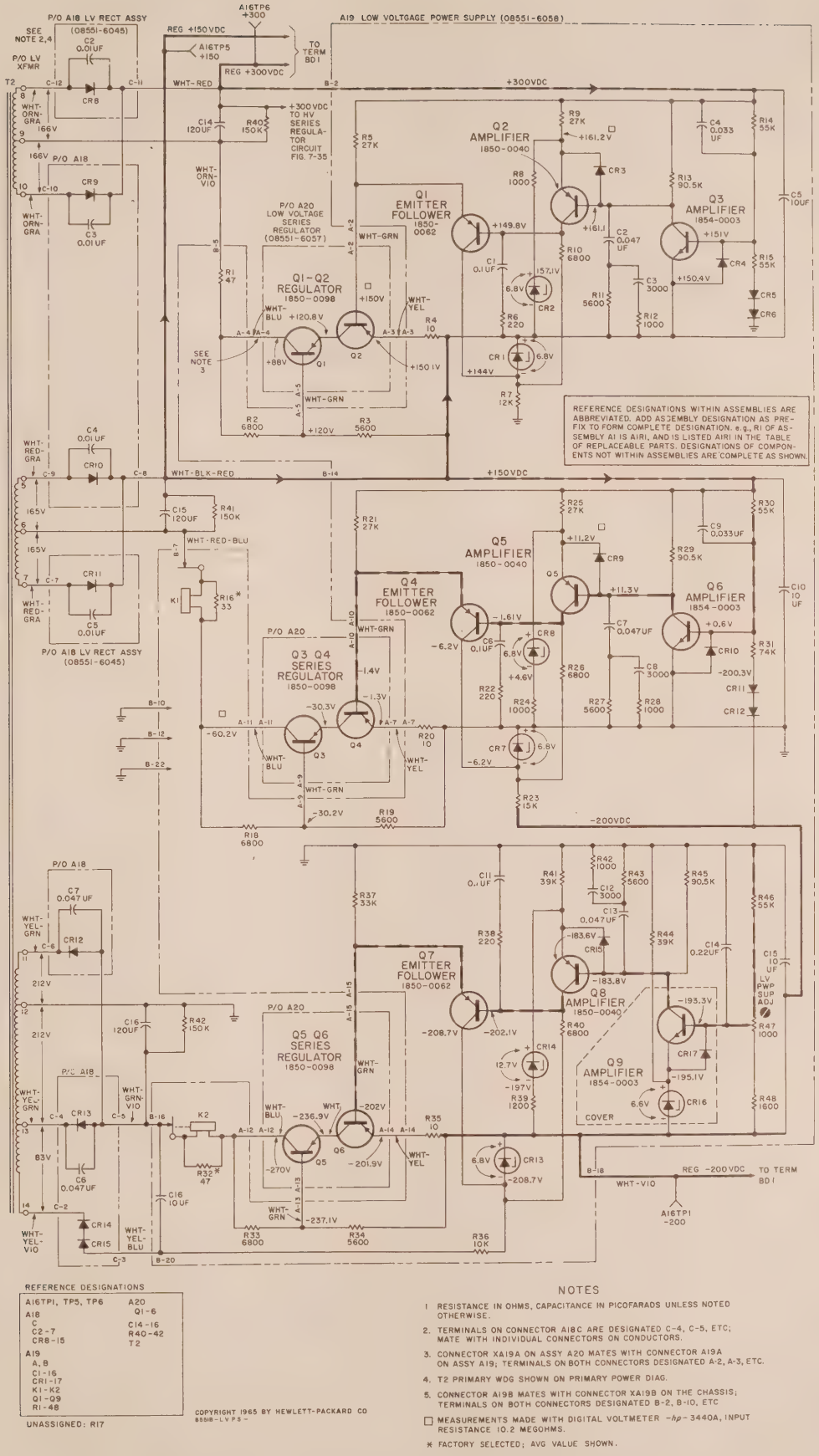


Figure 4-10. Low Voltage Power Supplies (sheet 2 of 2)

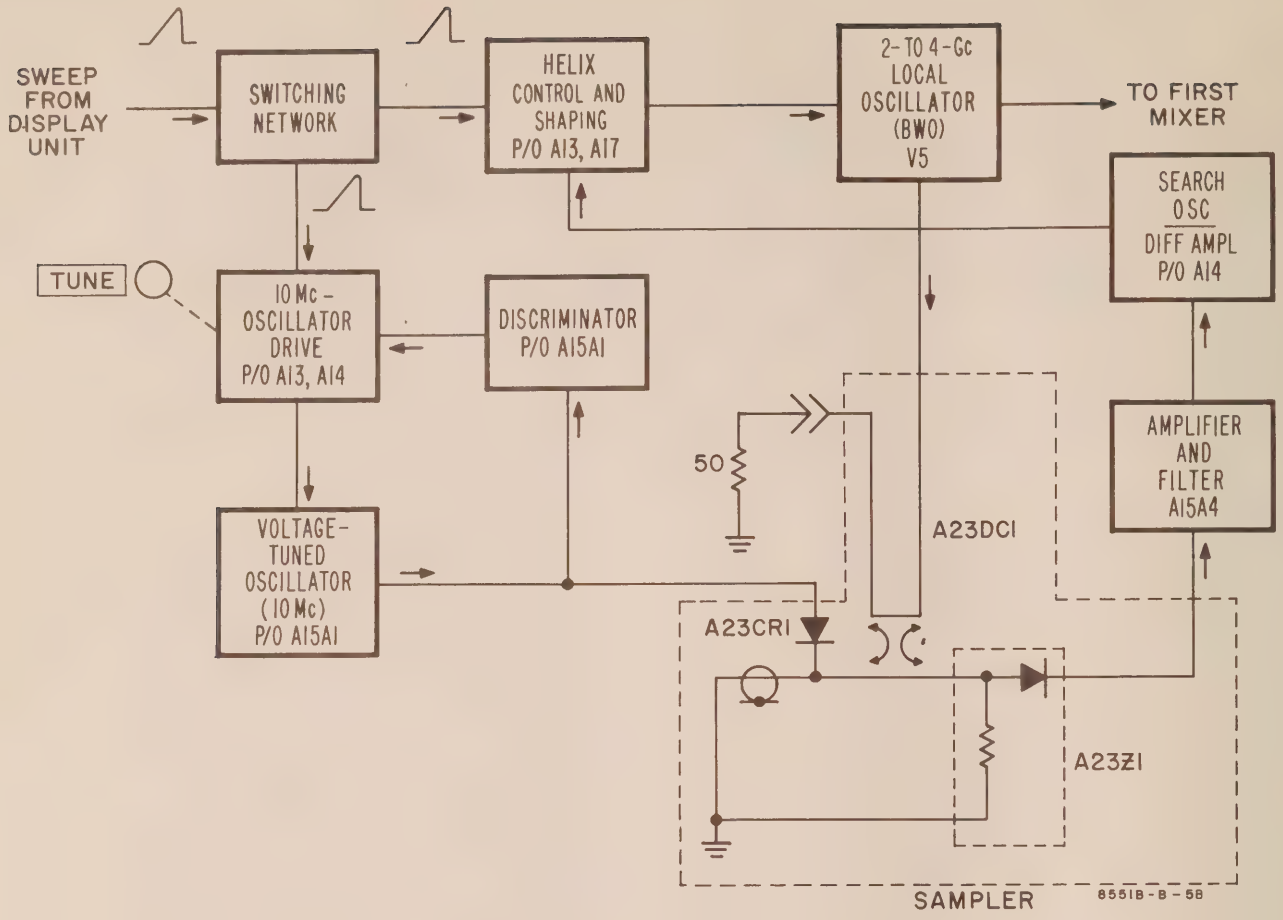


Figure 4-11. Phase-Lock Block Diagram

4-11. PHASE-LOCK LOOP.

4-12. The phase-lock loop reduces the residual FM of the BWO from about 40 kc to less than 1 kc and improves the linearity correlation between the sweep voltage from the 851 and the frequency from the BWO. A block diagram of the phase-lock loop is shown in Figure 4-11. The phase of the BWO is compared with the phase of a voltage-tuned 10-Mc (VTO) oscillator, and an error voltage is applied back to the helix power supply to hold the BWO frequency precisely at a multiple of the 10-Mc VTO frequency.

4-13. The 10-Mc VTO includes a Varicap as part of its frequency determining network. A Varicap is a reverse-biased semiconductor diode that acts as a variable capacitor. A change in back bias voltage applied to the diode changes the distance between the stored charges in the junction region of the diode and thus changes the spacing of the "plates" of the capacitor and the value of capacitance. The 10-Mc VTO, then, is a limited-range, swept-frequency oscillator that is swept in synchronism with the BWO. Because changing the capacitance of the Varicap does not produce a linear change in the VTO frequency with a linear voltage sweep, a linear discriminator is included in a negative feedback loop around the oscillator. This discriminator determines the tuning characteristic of the 10-Mc VTO and linearizes the frequency sweep.

4-14. The output of the 10-Mc VTO is applied to a pulse generator consisting of A23CR1 and a shorted transmission line. The pulse generator generates a 80-picosecond pulse which forward-biases the normally off Diode, A23CR2. During this 80-picosecond interval, the output of the BWO is applied to the amplifier of Assembly A15A4. Approximately 0.1 μs later (one period of the 10-Mc oscillator), another pulse is generated and the BWO output phase is again sampled. As long as the sample is taken at the same point of the BWO output cycle, the average value of the output of A15A4 is constant, the filtered output is constant, and no error voltage is applied back to the helix control circuits. However, should the sample point on the BWO output change, an error voltage is generated to change the BWO frequency such that sample point is returned to the proper point on the BWO output wave form.

4-15. When the BWO operates at 2 Gc, its output is sampled every 200 cycles (it is locked to the 200th harmonic of the 10-Mc VTO); when it operates at 4 Gc, its output is sampled every 400 cycles (400th harmonic of the VTO). Since the BWO sweep width varies from 200 to 400 times the sweep width of the 10-Mc VTO, it is necessary, for a constant BWO sweep width, to reduce the sweep range of the 10-Mc VTO by a factor of 2 as the BWO is tuned from 2 to 4 Gc. This reduction in the drive to the 10-Mc oscillator is accomplished by the TUNE control 2:1 potentiometer. Thus the 10-Mc VTO is swept over a 50-kc range with the BWO

tuned to 2 Gc and over a 25-kc range with the BWO tuned to 4 Gc. Another factor in the harmonic relationship between the 10-Mc VTO and the BWO is the actual frequency of the 10-Mc VTO. If the VTO had a 2:1 tuning range, 10 to 20 Mc for example, the BWO always could be locked to the 200th harmonic. However, the tuning range of the 10-Mc VTO is restricted such that the harmonic relationship between the 10-Mc VTO and the BWO frequency must be changed by 1 for each 10 Mc of tuning of the BWO. For the purpose of illustration assume no sweep. As the BWO is tuned upward from 2 Gc, the TUNE control also tunes the 10-Mc VTO to increase its frequency and maintain the harmonic relationship at 200. However, when the BWO frequency reaches 2.01 Gc, the 10-Mc VTO frequency is returned to 10 Mc, and as tuning continues the BWO and 10 Mc oscillators track with a harmonic relationship of 201. This recycling of the 10-Mc VTO continues for every 10-Mc change in BWO frequency until at a BWO frequency of 4 Gc the harmonic relationship is 400. When the sweep voltage is applied, it is simply superimposed upon this average value supplied by the TUNE control. The recycling of the 10-Mc VTO is accomplished by a single-turn potentiometer (R6) which has no stops and completes one revolution each time the BWO is tuned 10 Mc. (In the fine tuning mode, one revolution of the TUNE control changes BWO frequency by 10 Mc.)

4-16. Sampling pulses are generated by Step-Recovery Diode A23CR1 and a short transmission line which behaves, for all practical purposes, like an inductor in that it supports the flow of current.

a. During the positive half cycle of the 10-Mc reference signal, carriers are stored in the junction of Diode A23CR1. During the initial portion of the 10-Mc negative cycle, the diode supports a reverse current until the stored carriers are depleted. This reverse current is flowing through the diode into the short circuit.

b. When the carriers are depleted, current can no longer flow through Diode A23CR1, but at the same time the current cannot immediately collapse, and must flow in the only impedance left to take this current -- the impedance looking from the diode terminal into the transmission line (see Figure 4-11), looking, of course, both right and left and seeing the two impedances in parallel. The impedance that is seen at this junction is thus $Z_0/2$, and the resulting voltage is the current flowing in the diode (just before diode switching action took place) times $Z_0/2$.

c. This step in voltage propagates both to the left and the right. Going to the left it meets the short circuit which has a reflection coefficient magnitude of unity but reversed in sign such that the wave reflected off the short is equal in magnitude to that incident upon it but of opposite sign. Thus the pulse to the right consists of the initial positive rise followed by the negative step caused by the reflection off the short. Thus Diode A23CR2 conducts for a very short time -- the voltage fed to Diode A23CR2 is positive-going voltage, the duration of which is the round-trip transit time of the short circuit or approximately 80 picoseconds.

d. During the time the pulse is on, then, the conducting diode serves as a gate to sample the RF applied to Directional Coupler A23CD1. Thus for the duration of the pulse, Diode A23CR2 conducts RF from the BWO, and we get the pulses that contain the phase information required for phase-locking.

4-17. SWITCHING NETWORK.

4-18. The switching network is a series of attenuators which determine the amplitude of the sweep voltage applied to the BWO helix and the phase-lock loop. These attenuators determine the frequency range over which the BWO is swept. Although there are several sets of attenuators in the switching network, they are primarily controlled by just two switches, as shown in the simplified diagram of Figure 4-12. Note that part of the switching takes place in the input to the helix control input amplifier.

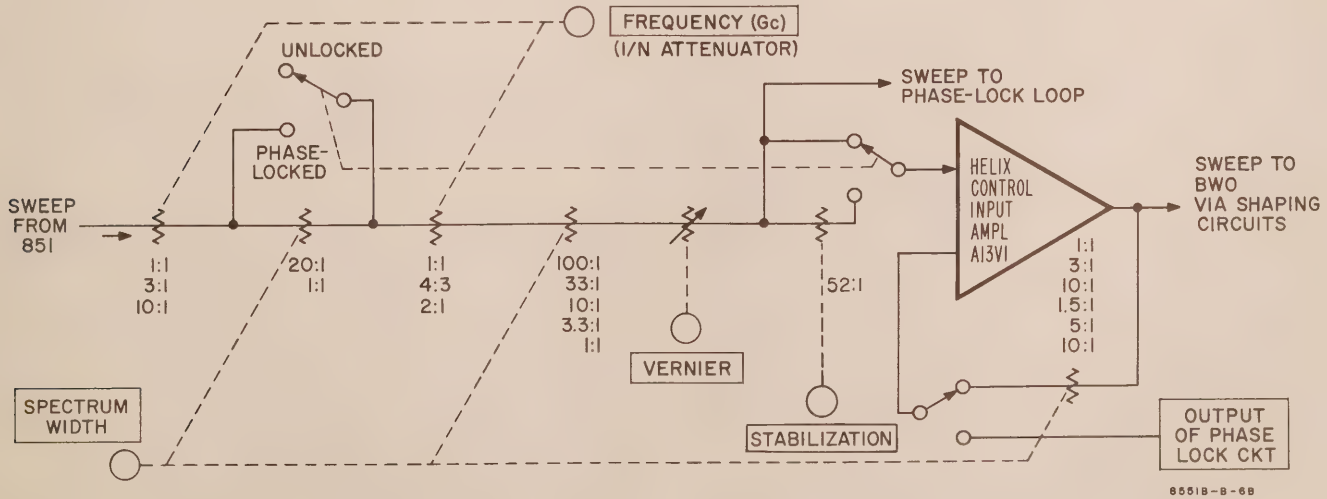


Figure 4-12. Simplified Switching Logic Diagram

Table 4-1. Spectrum Width Control Attenuation Summary

Spectrum Width	Attenuation 1st sec	Attenuation 2nd sec	Amp Gain	Total Atten $\left(\frac{1}{\text{gain}}\right)$
10 kc/cm	20:1	100:1	1	2000:1
30 kc/cm		33:1		660:1
100 kc/cm		10:1		200:1
300 kc/cm		33:1		66:1
1 Mc/cm		1:1		20:1
3 Mc/cm			3	6.6:1
10 Mc/cm			10	2:1
30 Mc/cm	1:1		1.5	0.66:1
100 Mc/cm			5	0.2:1
200 Mc/cm			10	0.1:1

Table 4-2. Frequency Control Attenuation Summary

Band	Harmonic Number	Attenuation 1st sec	Attenuation 2nd sec	Attenuation Total
.01-2 4-6	1	1:1	1:1	1:1
2-10	2	1:1	2:1	2:1
4-12.4	3	3:1	1:1	3:1
1.8-4.2	1	1:1	1:1	1:1
8-18	4	3:1	4:3	4:1
12-26	6	3:1	2:1	6:1
22-42	10	10:1	1:1	10:1

4-19. The SPECTRUM WIDTH control introduces attenuation which is inversely proportional to the selected spectrum width. The action of this control is summarized in Table 4-1. Note that the effect of switching the attenuator in the feedback loop of the helix control input amplifier is given in terms of amplifier gain. The FREQUENCY(GC) control, in addition to controlling the two attenuator sections as shown, rotates the dial drum in the window on the front panel of the instrument. The particular dial exposed is calibrated for input signals which mix with a given BWO harmonic. The number of the harmonic is also shown on the dial drum. Since the nth harmonic of the BWO sweeps n times as wide as the fundamental, attenuation introduced by the FREQUENCY(GC) control must be such that gain is inversely proportional to the harmonic number for which the exposed scale is calibrated. Thus the attenuators controlled by the FREQUENCY(GC) control are referred to as the 1/n attenuators. This attenuation is summarized in Table 4-2.

4-20. As noted above, the switching in the helix control input amplifier affects the gain of the amplifier. In actuality, shunt resistors are switched into the negative feedback circuit around the amplifier, reducing the feedback and increasing the gain. When operating the BWO in its stabilized (phase-locked) mode, the phase-lock error signal is applied to the negative feedback input of the helix control input amplifier. The output impedance of the phase-lock circuit has a shunting effect on the feedback circuit of the helix control input amplifier and therefore increases amplifier gain. To compensate for the increased gain of the amplifier, the switching network further attenuates the sweep signal applied to the amplifier by bypassing the 20:1 attenuator and introducing a 52:1 attenuator, as shown in Figure 4-12.

4-21. One switching complication is not shown in Figure 4-12. In the phase-locked mode of operation, the SPECTRUM WIDTH control has no effect on the amplifier gain. However, the 4 - 12.4 Gc band and the top three frequency bands can be stabilized on the 3 Mc/cm spectrum width and the top frequency band can be stabilized on the 10 Mc/cm spectrum width. Table 4-1 indicates that amplifier gain must be increased on these two ranges. Since the helix control input amplifier gain is not changed, the attenuation of the first section of the 1/n attenuator is reduced instead, thereby increasing the sweep signal to both the phase-lock loop and the amplifier.

4-22. SIGNAL IDENTIFIER.

4-23. Since the 8551B uses no RF preselection, all signals that are applied to the input reach the first mixer. There the input signals mix with the signal from the BWO and its harmonics. Any mixing product resulting in a 2-Gc difference frequency appears as a signal on the 851 CRT. Thus any signal satisfying the equation $F_S - nf_{LO} = \pm 2$ Gc (where F_S = the input signal frequency, f_{LO} = the BWO frequency, and n is the harmonic of the BWO frequency) will appear on the display. The signal identifier provides a means of identifying any signal, satisfying the above equation, that appears on CRT.

Note

Signal identifying technique cannot be used on the 1.8 to 4.2 range of FREQUENCY(GC) switch (200 Mc IF).

4-24. The signal identifier operates by changing the frequency of the third local oscillator, the 180-Mc oscillator. This oscillator includes a Varicap as part of its frequency determining network (the Varicap is described in Paragraph 4-13). The reverse bias applied to the Varicap in the 180-Mc oscillator is determined by a resistive divider stick on the SIGNAL IDENTIFIER switch on the front panel of the 8551B. The switch has an OFF position, a REFERENCE position that is used for initial setup of the display, and 10 additional positions, each identified with a harmonic number. As the switch is advanced to the next highest

harmonic number, the bias to the Varicap in the 180-Mc oscillator is changed such that the oscillator frequency increases by approximately 18.18 kc. The result for a particular signal on the display is a shift of 2 cm when the SIGNAL IDENTIFIER switch is rotated from the REFERENCE position to the position indicating the BWO harmonic used to mix with the particular signal being displayed. The shift is to the left if the input signal is higher than the BWO signal, to the right if the input signal is lower than the BWO signal.

4-25. The mechanism can be explained as follows:

a. The SIGNAL IDENTIFIER switch is initially set to the REFERENCE position. In this position, the SIGNAL IDENTIFIER bypasses the 1/n attenuators of Figure 4-4. Thus the BWO fundamental sweeps at a rate determined by the SPECTRUM WIDTH control setting regardless of the selected frequency range. However, since the instrument is calibrated for identifying signals on the 100-kc/cm spectrum width, this discussion is based on the assumption that the SPECTRUM WIDTH is set to 100 kc/cm. It is important to note that the 851 CRT graticule calibration is n times 100 kc/cm, where n is the harmonic of the BWO used to mix with the particular signal being identified. That is, for fundamental mixing, the spectrum width calibration is 100 kc/cm, for 2nd harmonic mixing the calibration is 200 kc/cm, etc.

b. As the SIGNAL IDENTIFIER switch is rotated clockwise from the REFERENCE position, the 180-Mc oscillator frequency is increased 18.18 kc per step. The result is an increase of the first IF by 200 kc per step. For example, when the SIGNAL IDENTIFIER switch is set to the 1 position, the frequency of the 180-Mc oscillator becomes 180.01818 Mc. For a final IF of 20 Mc the input to the third mixer, or the output of the 200 Mc IF, must be 200.01818 Mc. The harmonic generator, which multiplies the 180-Mc oscillator output by 10, has an output of 1800.1818 Mc, and this signal is applied to the second mixer. To produce a second IF of 200.01818 Mc with a second LO frequency of 1800.1818 Mc, the first IF must be 2000.19998 Mc or, for all practical purposes, 2.0002 Gc.

c. To understand the signal identifier circuit, it is necessary to understand the effect of changing the first IF on the frequency calibration of the 851 CRT. With the SIGNAL IDENTIFIER switch set to REFERENCE, the center vertical graticule line on the CRT corresponds to nf_{LO} ±2 Gc. That is, a signal at one of these frequencies will cause a response at the center of the CRT. When the SIGNAL IDENTIFIER switch is set to the 1 position, the CRT frequency calibration is shifted so that the center graticule line corresponds to the frequency nf_{LO} ±2.0002 Gc. Thus, signals previously appearing at the center of the CRT are shifted by a factor of 200 kc. The extend of the shift is inversely proportional to the harmonic of the BWO with which the signal was mixing because the spectrum width calibration is n times 100 kc/cm. The direction of the shift depends upon whether the input signal frequency is above or below the BWO harmonic with which it is mixing. For example, a signal at nf_{LO} + 2 Gc (the input signal frequency is above the BWO harmonic with which it is mixing) is lower in frequency than nf_{LO} + 2.0002 Gc and therefore is shifted to the left of center. A signal at nf_{LO} - 2 Gc is higher in frequency than nf_{LO} - 2.0002 Gc and therefore is shifted to the right of center.

d. To summarize, the SIGNAL IDENTIFIER switch changes the calibration of the CRT by 200 kc per step. All signals appearing on the CRT are shifted by 2/n centimeters so that the number of steps required to shift a given signal by 2 cm indicates the harmonic of the BWO with which that signal is mixing. The direction of the shift indicates whether the signal frequency is higher or lower than the frequency of the BWO harmonic. The frequency of the input signal can be determined from the formula $F_s = nf_{LO}$ ±2 Gc, the choice of sign depending upon the direction of the signal shift on the CRT. If the harmonic number is 1, 2, 3, 4, 6, or 10, the appropriate dial scale can be positioned with the FREQUENCY(GC) switch and the signal frequency read directly.

SECTION V

MAINTENANCE

5-1. INTRODUCTION.

5-2. Information required to maintain the 8551B Spectrum Analyzer RF Section in working condition is provided in Sections V and VII. Type of information covered is summarized briefly in Paragraph 5-7.

5-3. MAINTENANCE PRECAUTIONS.

WARNINGS

VOLTAGES IN EXCESS OF 1000 VOLTS INSIDE CABINET

- ► under side on BWO tube terminals
- ► under side on HV power supply
- ► under side on Helix voltage shaper
- ► under side on HV overload relay

STRONG, PERMANENT MAGNETIC FIELD AROUND BWO TUBE

Remove wristwatch before working near BWO tube. Keep metal tools clear of BWO tube.

DO NOT SHORT-CIRCUIT CASES OF CHASSIS-MOUNTED TRANSISTORS TO CHASSIS

5-4. PERIODIC MAINTENANCE.

5-5. CLEANING AND LUBRICATION.

5-6. Inspect the air filter regularly and, if necessary, remove and wash in detergent and water. Dry filter and replace: no oiling or coating of the filter is necessary. Keep the filter clean. Unrestricted air flow gives longest component life. Inspect fan and screened vent; using light machine oil, lubricate fan approximately every six months.

5-7. CONTENT.

a. Performance Checks. Tables 5-3 and 5-10; Paragraphs 5-10 through 5-46.

b. Adjustments. Except for front-panel adjustments, adjustment procedures are given in brief form in Table 5-14, and in more detail in Paragraphs 5-50 through 5-106. Front-panel adjustments are given in Section III.

c. Required Test Equipment. Instruments required for tests and adjustments are listed, together with minimum specifications, in Table 5-1; each instrument is given a number reference. Accessories required for the procedures are listed in Table 5-2; each accessory is given a letter reference. Ahead of each section of the procedure, equipment required is listed by its reference number or letter.

d. Waveforms. Table 7-1.

e. Schematics:

(1) RF Input . . . . . Figure 7-15
(2) Converter . . . . . " 7-18
(3) Switching Logic. . . . . " 7-21
(4) 10 Mc Osc/Disc . . . . . " 7-26
(5) Sampler/Search Drive . . . . . " 7-29
(6) Helix Control Input . . . . . " 7-32
(7) Helix Control. . . . . " 7-35
(8) Primary Power. . . . . " 7-38
(9) LV Power Supply . . . . . " 7-41

f. Assembly and Component Identification. Designations for most parts are silk-screened on the chassis. In addition, the following aids are provided.

(1) Locations of assemblies are called out in Figures 7-2, 7-3, and 7-4.

(2) Table 5-9 lists controls, switches, and connectors alphabetically, and gives the schematic on which each is shown.

(3) Table 5-15 lists assemblies numerically and indexes each to its schematic and circuit board or assembly illustration. Figure 7-1 shows the relation between RF Section assemblies.

(4) Table 7-2 lists chassis-mounted components numerically by reference designation, references the schematic on which each is shown, and either tells where the part is located or references an illustration which calls out the part.

(5) Each board-mounted component is called out on a picture of the board. In the main, these illustrations face the schematic in which the assembly appears. For help in locating any board, refer to Table 5-15 or the List of Illustrations in the front of the Manual. Paragraph 5-170 includes suggestions on how to proceed when it is necessary to locate a part.

g. Adjustments Required After Component Replacement: Tables 5-37 and 5-38.

h. Troubleshooting Information. See Paragraphs 5-106 through 5-179.

i. Disassembly Instructions.

(1) Cover and Side Panel Removal, Paragraph 5-47.

(2) Freeing 8551B Front Panel, Paragraph 5-229.

Table 5-1. Test Equipment Required

Ref. No.	Instrument Type	Critical Specifications	Recommended Equipment
1	Oscilloscope Low-Frequency	Sensitivity: 0.1 mV/cm	HP 130C 200 μV/cm Oscilloscope
2	Voltmeter	Accuracy: 0.05% Input Impedance: 10.2 megohms Automatic range selection	HP 3440 Digital Voltmeter with HP 3442 Automatic Range Selector plug-in
3	Transformer for varying input voltage	Range: 103 to 127 Vac at approximately 2-1/2 amps Voltmeter Range: 103 to 127 volts Voltmeter Accuracy: ±1 volt	General Radio Type W5MT3A or Superior Electric UC1M
4	Clip-on DC Milliammeter	Accuracy: ±0.1 mA ±3% of FS Range: 0.1 mA to 0.5 mA	HP 428B
5	DC Voltmeter/Ohmmeter	Accuracy: ±3% of FS Input Impedance: 100 megohms Can accommodate voltage-divider probe	HP 410B/C Electronic Voltmeter
6	DC Voltage Divider	Accuracy: ±5% Division Ratio: 100:1 Input Impedance: 10,000 megohms Maximum Volts: 6,000	HP 11045A DC Voltage Divider
7	Electronic Counter	Frequency: 200 Mc Accuracy: 5 parts in 10^8 ±1 count Multiple period averaging feature	HP 5245L Electronic Counter and 5253B Frequency Converter
8	VHF Signal Generator	Frequency Range: 10 to 455 Mc	HP 608C/E/F
9	HF Signal Generator	Output Frequency: 50 kc to 20 Mc Frequency Accuracy: ±1% Output: at least 3 volts into 50 ohms Modulating capability with external modulating-voltage input Meter which monitors generator output level	HP 606A/B
10	VHF Attenuator	To 60 dB, in 10-dB steps, usable at 2 Gc	HP 355D
11	UHF Signal Generator	Frequency: 800 Mc to 2 Gc Calibrated output attenuator Can be set for leveled output	HP 8614A/B
12	Deleted		
13	Deleted		

(Continued)

Table 5-1. Test Equipment Required (Cont.)

Ref. No.	Instrument Type	Critical Specifications	Recommended Equipment
14	1-Mc, 10-Mc, 100-Mc Marker Generator	Accuracy: 0.5% Output Freqs: spaced at 1 Mc, 10 Mc, and 100 Mc	HP 8406A Frequency Comb Generator
15	Power Meter	Frequency: 180 Mc to 10 Gc Accuracy: ±3%	HP 431B Power Meter & HP 478A Thermistor Mount
16	Coaxial Fixed Attenuator	Attenuation: 20 dB Frequency Range: 10.1 Mc to 12.4 Gc	HP 8491A - Option 20
17	Frequency Meter	Range: 2 to 4 Gc Accuracy: ±1/2%	HP 536A
18	SHF Signal Generator	Frequency: 7 to 11 Gc Calibrated output attenuator	HP 620A/B
19	SHF Signal Generator	Frequency: 1.8 to 4.2 Gc Calibrated output attenuator	HP 8616A/B
20	SHF Signal Generator	Frequency: 3.8 to 7.6 Gc	HP 618B/C
21	Coaxial Fixed Attenuator	Attenuation: 10 dB Frequency Range: 10 Mc to 12.4 Gc	HP 8491A - Option 10
22	AC Voltmeter	Range: to 1.5 mV Frequency: 50 to 60 cycles Accuracy: ±3% of FS	HP 400D/H VTVM
23	HV DC Voltmeter	Range: 300 to 2500 Vdc Accuracy: ±3%	Simpson 260
24	HV Probe	Voltage Rating: 5000 Vdc	Simpson 0507
25	Reference Noise Source	Frequency: 200 Mc	HP 343A VHF Noise Source
26	LF Oscillator	Output Frequency: 100 cps Output Volts: 2 V	HP 200CD Wide Range Oscillator
27	Noise Figure Meter	Input Frequency: 20 Mc	HP J16-340B (340B with 20 Mc Input)
28	Milliammeter	±2% ammeter	HP 412A DC Voltmeter-Ohmmeter-Ammeter
29	Reference Noise Source	Frequency: 2 Gc	HP 349A UHF Noise Source
30	RF Millivoltmeter	Read 0.01 volt at 20 Mc	HP 411A
31	SHF Sweep Oscillator	Frequency Range: 4 to 12.4 GHz Can be set for leveled output	HP 8690A w/HP 8693A/B and 8694A/B RF Units
32	UHF Signal Generator	Frequency Range: 450 to 1230 Mc	HP 612A

Table 5-2. Test Accessories Required

Ref.	Instrument Type	Critical Specifications	Recommended Equipment
A	Cable Assembly (2 each)	Shielded 50-ohm cable terminated with dual banana plugs	HP 11000A
B	Cable Assembly	Shielded 50-ohm cable, dual banana plug to alligator clips	HP 11037A
C	Cable Assembly (3 each)	RG-58C/U, BNC male connector to dual banana plug	HP 11001A
D	Cable Assembly (4 each)	RG-58C/U, BNC male connector to BNC male connector	HP 10503A
E	Adapter	BNC female connector to dual banana plug	HP 10111A
F	BNC Tee	BNC male connector to 2 BNC female connectors	UG-274A/U HP 1250-0781
G	Plastic tuning wand	Approximately 7" long x 3/8" diameter plastic	Modified* General Cement #GC8721
H	Cable Assembly	Shielded coax, Type N male connector to Type N male, 3 feet long	Special HP 11500A
J	Adapter	BNC male connector to BNC male connector	UG-491A/U
K	Screwholding screwdriver		Quick Wedge 1734-XM or 736-50
L	Adapter (2 each)	Type N male connector to BNC female connector	UG-201A/U HP 1250-0780
M	Tuning Wand	Plastic tuning wand	Walsco 2547
N	Open-end Wrench	3/8" wrench	1212 Proto
O	Adapter	Type N female connector to BNC female connector	FXR 21850
P	Type N Tee	Type N male connector to type N female connectors	UG-107B/U
Q	Adapter	BNC female connector to BNC female connector	UG-914/U (HP 1250-0080)
R	Adapter	X-band waveguide-to-coax	HP X281A

* One end modified by cutting shield away, exposing tuning blade.

(Continued)

Table 5-2. Test Accessories Required (Cont.)

Ref.	Instrument Type	Critical Specifications	Recommended Equipment
S	Adapter	Type N male connector to Type N male connector	UG-57B/U (HP 1250-0778)
T	Soldering Tool	Approximately 6-1/2" long slender metal rod with curved pointed end	HP 8690-0015
U	Test Leads	Dual banana plug to probe and alligator clip	HP 11003A
V	Capacitor	0.05 uF, 3000 VDCW	Chicago Condenser Corp PMS 503-3M
W	Variable Resistor	200 K, 2 W	Allen Bradley, Type J
X	Soldering Iron	Tip: approximately 1/8"	Ungar #4037, 47 1/2 W, Ungar PL #113
Y	Resistor	68 ohms ±10% 1 W	
Z	Resistor	1.1 megohms	Int'l Resistance Co. CEC T-O
ZA	Adapter	Type N female connector to Type N female connector	UG-29B/U (HP 1250-0777)
AA	AC Probe	Divider Ratio: 10:1	HP 10001A Divider Probe
AB	Type N Right-angle Adapter	Type N male connector to Type N female connector	UG-27C/U
AC	Adapter	Type N female connector to BNC male connector	UG-349A/U HP 1250-0077
AD	Pickup Loop		See Figure 5-6
AE	Crowfoot Wrench	Right-angle wrench with well-insulated handle for loosening 7/16" hex nut	Proto Tools 4914
AF	Adapter	Type N male connector to BNC male connector	UG-1034/U HP 1250-0082
AG	50-ohm coaxial termination	SWR: 1.05, dc to 4 Gc Wattage rating: 1/2 W	HP 908A Coaxial Termination
AH	2 Gc IF Tuning Driver	Fits 2 Gc IF Amplifier A5 locking and adjustment screws	08551-2297

Table 5-3. Front Panel Checks

Par. Ref.	Control/Feature Under Check	Procedure	Proper Performance
5-11	Time delay, HV turn-on	Set LINE to ON.	ON lamp should light after 60 to 90 seconds
5-12	SIGNAL IDENTIFIER	Follow procedure given in Figure 3-5.	Display shift which indicates correct harmonic number: 2 cm ±0.5 cm
5-13	Phase-lock	Perform steps 1-7, Fig. 3-3, using any signal between 10.1 Mc and 12.4 Gc. Perform SPECTRUM CENTERING adjustment; see Par. 3-32. Stabilize; see Fig. 3-4. Set STABILIZATION to OSC TRACK, and turn TUNE.	Position of display will shift as TUNE is turned; this indicates BWO output is phase-locked to reference oscillator.
5-14	Phase-lock tuning	Change frequency of input by any amount up to 2 Gc. Set STABILIZATION to STABILIZED. Bring signal on display with TUNE; center it. Set STABILIZATION to OSC TRACK, and turn TUNE.	Position of display shifts as TUNE is turned.

5-8. PERFORMANCE CHECKS.

5-9. Front panel checks for incoming or routine inspection are given in Table 5-3, and procedures for verifying that the 8551B meets specifications are given in Table 5-10. Both sets of procedures are spelled out in greater detail in Paragraphs 5-10 through 5-46. Both Tables reference the more detailed procedures as an aid in case brevity has obscured clarity. Table 5-10 is in test-card form, briefly describes test sequences, and provides space for recording measurement results. Allow at least a half-hour warm-up before making checks.

5-10. FRONT PANEL CHECKS.

5-11. TIME DELAY, HIGH-VOLTAGE TURN-ON.

a. With the 8551B plugged into a 115/230-V, 50 to 60 cps source, set LINE to ON.

b. The ON indicator lamp should light after 60 to 90 seconds.

5-12. SIGNAL IDENTIFIER OPERATION. Check of the signal identifier feature may be made with a signal of any frequency. Perform the procedure given in Figure 3-5. (A shift of 2 cm (±0.5 cm) indicates SIGNAL IDENTIFIER is set to correct harmonic number.)

5-13. PHASE-LOCK CHECK.

a. Equipment Required. A signal source operating anywhere in the 10.1-Mc to 12.4-Gc range; any of the signal generators listed in Table 5-4 is suitable.

b. Procedure.

(1) Perform steps 1-7 of initial operating procedure, Figure 3-3.

(2) Perform SPECTRUM CENTERING adjustment; see Paragraph 3-34.

(3) Perform stabilization procedure; see Figure 3-4.

Table 5-4. HP Signal Generators, 10 Mc to 11 Gc

Signal Generator	Frequency Range	Cable Req'd	Adapter Req'd
608C/E/F	10 to 480 Mc	H**	0**
612A UHF	450 to 1230 Mc	H**	0**
8614A	800 Mc to 2.4 Gc	H**	0**
8616A	1.8 to 4.5 Gc	H**	0**
618B	3.8 to 6.7 Gc	H**	0**
620A	7 to 11 Gc	H**	0**
**See Table 5-2			

(4) Set STABILIZATION to OSC TRACK, and turn TUNE. (Shift of display as TUNE is turned indicates BWO output is phase-locked to that of 10-Mc reference oscillator.)

(5) Return STABILIZATION to STABILIZED.

5-14. PHASE-LOCK TUNING.

a. With setup same as in Paragraph 5-13, change frequency of input signal by any amount up to 2 Gc.

b. Bring signal on display with TUNE; center it.

c. Set STABILIZATION switch to OSC TRACK, and turn TUNE. (Shift of display as TUNE is turned (with STABILIZATION at OSC TRACK) indicates BWO output is phase-locked to that of 10-Mc reference oscillator.)

5-15. SWEPT-FREQUENCY LINEARITY.

Specification:

Spectrum Widths 200 Mc/cm to 3 Mc/cm: Frequency error between two points on the display is less than ±10% ±3 Mc of the indicated frequency separation between the two points.

Spectrum Widths 1 Mc/cm to 10 kc/cm (stabilized tuning mode): Frequency error between two points on the display is less than ±5% of the indicated frequency separation between the two points.

5-16. EQUIPMENT REQUIRED.

a. Frequency Comb Generator (8406A): item 14 in Table 5-1.

b. Coaxial cable terminated with Type N male connectors (11500A): item H in Table 5-2.

5-17. PROCEDURE, STABILIZED. With the analyzer stabilized, a check of linearity on one band checks the linearity on any other band that can be stabilized. The following procedure checks linearity with SPECTRUM WIDTH at 1 MC, and confirms linearity at 300 KC, 100 KC, 30 KC, and 10 KC.

a. Connect frequency comb generator to 8551B INPUT, as indicated in Figure 5-1. Depress 1-Mc control on generator. At this setting, generator delivers frequency markers spaced 1 Mc apart.

b. On Analyzer, set

ATTENUATOR(DB)	10 (or 0)
VERT DISPLAY	LOG
I. F. GAIN(DB)	70 + 10
SPECTRUM WIDTH	1 MC/CM

c. Stabilize the Analyzer; see Figure 3-4.

d. Turn TUNE through its range noting, at as many regions across the band as desired, marker signals and spacing of intervals. (Across the range of the analyzer, the 10-cm display should never have less than 9.5 marker intervals nor more than 10.5 intervals.)

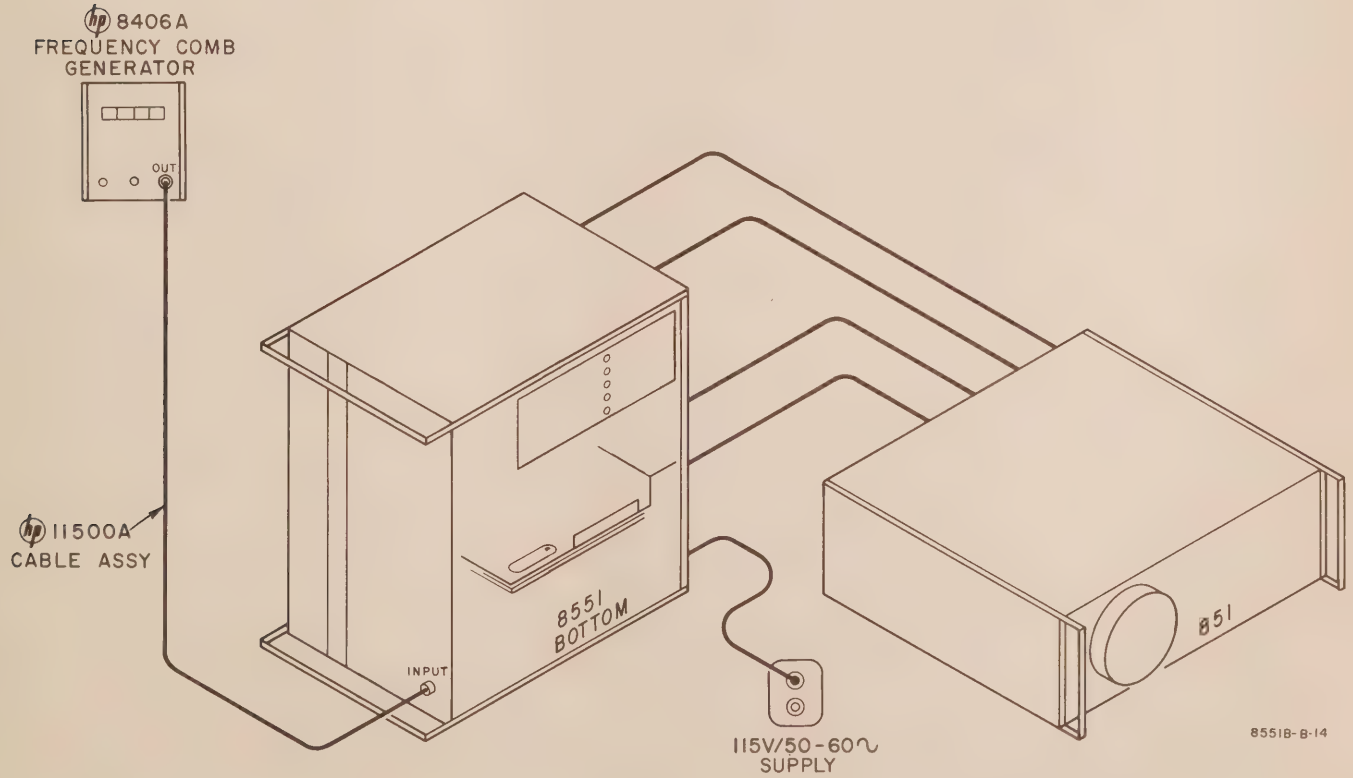


Figure 5-1. Measurement Setup, Frequency Linearity Check

Table 5-5. Sweep Linearity Check, Unstabilized

SPECTRUM WIDTH Setting	Comb Generator Setting	Marker Intervals in 10-cm display	
		⟨	⟩
3 MC/CM	1MC	24	36
10 MC/CM	10MC	9	11
30 MC/CM	10MC	27	33
100 MC/CM	100MC	9	11
200 MC/CM	100MC	18	22

5-18. PROCEDURE, UNSTABILIZED. Method is same as for stabilized procedure except that STABILIZATION is set for UNSTABILIZED. Settings and limits as TUNE is turned through its range is given in Table 5-5.

5-19. TUNING ACCURACY.

Specification: ±1% of LO fundamental or harmonic.

5-20. EQUIPMENT REQUIRED.

a. Power Meter and Thermistor Mount (431B and 478A): item 15 in Table 5-1.

b. 20-dB Attenuator (8491 Option 20): item 16 in Table 5-1.

c. Coaxial cable terminated with Type N male connectors (11500A): item H in Table 5-2.

d. Coaxial Frequency Meter (536A): item 17 in Table 5-1.

5-21. SETUP. Connect equipment to the LO OUTPUT TERMINATE IN 50 OHM connector on 8551 rear panel, as indicated in Figure 5-2. No input signal is required for this check.

5-22. PROCEDURE.

a. Set LINE to ON.

b. Set:
SPECTRUM WIDTH VERNIER. . . . max ccw
STABILIZATION. . . . . UNSTABILIZED

c. Set TUNE for 2 Gc on LOCAL OSC FREQ scale. Adjust frequency meter for power meter dip, and read frequency meter for frequency at which dip occurs; reading on frequency meter should be within ±20 Mc of 2 Gc.

e. Repeat this procedure across the band, using settings given in Table 5-6.

Table 5-6. Tuning Accuracy Check Data

TUNE Setting (Gc)	Frequency Meter Reading (Gc)	
	Min	Max
2.0	1.98	2.02
2.2	2.18	2.22
2.4	2.37	2.42
2.6	2.57	2.63
2.8	2.77	2.83
3.0	2.97	3.03
3.2	3.17	3.23
3.4	3.37	3.43
3.6	3.56	3.64
3.8	3.76	3.84
4.0	3.96	4.04

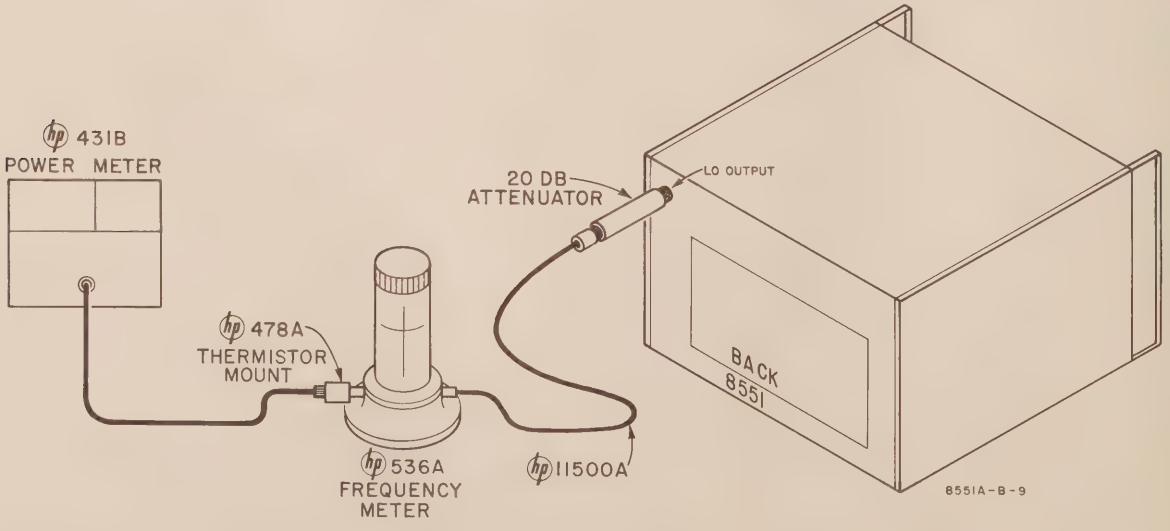


Figure 5-2. Measurement Setup, Tuning Accuracy Check

5-23. SENSITIVITY.

Specification:

Sensitivity ($\frac{\text{Signal power + noise power}}{\text{noise power}} = 2$; 10 kc IF bandwidth)*:

10.1 Mc to 100 Mc, -98 dBm, fundamental mixing
100 Mc to 1.8 Gc, -100 dBm, fundamental mixing
1.8 to 4.2 Gc, -100 dBm, fundamental mixing (using 200 Mc 1st IF)
2.4 to 4.1 Gc, -90 dBm, second harmonic mixing
4.1 to 6 Gc, -100 dBm, fundamental mixing
6 to 8 Gc, -88 dBm, third harmonic mixing
8 to 10 Gc, -91 dBm, second harmonic mixing
10 to 12.0 Gc, -85 dBm, third harmonic mixing
8.2 to 18 Gc, -80 dBm
18 to 26.5 Gc, -75 dBm
26.5 to 40 Gc, -65 dBm

*With source stability better than 1 kc, greater sensitivity can be achieved using narrower IF bandwidth.

5-24. EQUIPMENT REQUIRED. To check sensitivity across the 10.1-Mc to 40-Gc range of the analyzer requires test equipment equal to that listed in Table 5-7. The residual FM of the input signal must be less than 10 kc peak-to-peak to measure the sensitivity of the analyzer for the 10 kc IF bandwidth. With signal generators such as HP Models 606, 608, 612, 8614 and 8616, a direct measurement of sensitivity may be easily made at frequencies up to 4.2 Gc. Above 4.2 Gc (where signal generators having residual FM greater than 10 kc peak-to-peak are fairly common) an indirect method for measurement of sensitivity is used.

5-25. DIRECT SENSITIVITY MEASUREMENT 10.1-Mc to 4.2-Gc.

a. Connect a sensitive RF millivoltmeter, such as the HP 411A, to IF TEST POINT on the 851 rear panel.

b. Set

851 Display Section:
VERT DISPLAY. . . . . LIN
I.F. BANDWIDTH. 10KC
I.F. GAIN(DB) . . . . . 80 (70 + 10)
SWEEP TIME . . . . . 3 MILLISEC/CM

8551 RF Section:
FREQUENCY(GC). 01-2
SPECTRUM WIDTH. . . . . 1 MC/CM
SPECTRUM WIDTH VERNIER . CAL (max ccw)
ATTENUATOR(DB) 10
SIGNAL IDENTIFIER (Fs) . . . . . .OFF
LINE . . . . . STANDBY

c. Set TUNE for any frequency between 800 Mc and 1.8 Gc frequency scale.

d. Note and record millivoltmeter reading; this is the level of the noise and is the reference.

e. Set output of signal generator to -60 dBm at frequency set in step c above. Connect signal generator to analyzer INPUT.

f. Stabilize analyzer; refer to procedure contained in Figure 3-4.

g. Reduce 851 RF GAIN(DB) by 3 dB (set to 70 + 7)

h. Adjust SPECTRUM WIDTH VERNIER to max ccw while adjusting TUNE to keep signal at center of display CRT. Reduce signal generator output level until millivoltmeter reading is the same as that recorded in step d above.

i. Record signal generator output level (for example -92 dBm). Add the 10 dB of input attenuation at the analyzer input (in the example, -102 dBm). This power level is the sensitivity of the analyzer for 10-kc IF bandwidth at the measured frequency and must be $\leq$ -100 dBm. Refer to Table 1-1 for sensitivity specifications at other frequency ranges.

5-26. INDIRECT SENSITIVITY MEASUREMENT 4.2- to 40 Gc.

a. To determine relative sensitivity of 1-Mc and

Table 5-7. Test Equipment Suitable for Sensitivity-Check Setups

Analyzer Range (Gc)	Suitable Signal Source	Accessories Required
.01 - 2	608C VHF Signal Generator (10 Mc to 480 Mc)	11500A Cable Assembly
	612A UHF Signal Generator (450 Mc to 1230 Mc)	11500A Cable Assembly
	8614A/B Signal Generator (800 Mc to 2.4 Gc)	11500A Cable Assembly
1.8 - 4.2	8616A/B Signal Generator (1.8 Gc to 4.5 Gc)	11500A Cable Assembly
4 - 6	618B SHF Signal Generator (3.8 Gc to 7.6 Gc)	11500A Cable Assembly
6 - 10	620A SHF Signal Generator (7 Gc to 11 Gc)	11500A Cable Assembly
8 - 12.4	8690 Sweep Oscillator	8694A/B RF Unit
12.4 - 40	8690 Sweep Oscillator	8695A/B RF Unit (12.4 to 18 Gc)
		8696A/B RF Unit (18 to 26.5 Gc)
		8697A/B RF Unit (26.5 to 40 Gc)

10-kc IF bandwidth using signal generators with residual FM greater than 10 kc peak-to-peak:

(1) Perform steps a through i of Paragraph 5-25. Record the 10-kc sensitivity determined in step i (for example, -102 dBm).

(2) Repeat steps a through i of Paragraph 5-25 using IF bandwidth of 1 Mc. Record sensitivity determined in step i (for example, -83 dBm).

(3) The relative sensitivity of the 10-kc and 1-Mc IF bandwidth is the difference between readings of steps 1 and 2 above (in the example, -19 dBm).

b. Measure the sensitivity at any frequency, using the method contained in Paragraph 5-25 with an IF bandwidth of 1 Mc. Use the SIGNAL IDENTIFIER switch to determine the appropriate position for the FREQUENCY(GC) switch (see Figure 3-5). Be sure to return SIGNAL IDENTIFIER switch to OFF after completion of signal identification technique.

c. Add the relative sensitivity determined in step 3 above to determine the equivalent 10-kc sensitivity. For example, if the sensitivity measured in step b above was -70 dBm at 8 Gc, the 10-kc bandwidth sensitivity would be -89 dBm (-70 dBm + -19 dBm).

5-27. MAXIMUM INPUT POWER (FOR 1-DB COMPRESSION.

Specification:

Coaxial Input:

ATTEN(DB) Setting	Typical Max Input (Peak or Avg dBm)
0	-10
10	0
20	+10
30	+20
40 thru 60	+30

Waveguide Input:	Typical Max Input (Peak or Avg dBm)
11521A (8.2-12.4 Gc)	-15
11517A (12.4-40.0 Gc)	-15

5-28. EQUIPMENT REQUIRED. Following procedures assume use of equipments listed. The frequency specified is that at which compression is worst; any frequency in the range may be used.

a. VHF Signal Generator (608C/E/F): item 8 in Table 5-1.

b. Power Meter and Thermistor Mount (431B and 478A): item 15 in Table 5-1.

5-29. PROCEDURE:

a. With the signal generator set for 50 Mc, calibrate output attenuator with power meter for -5 dBm, -15 dBm, and -25 dBm. Leave signal generator set for 50 Mc at -5 dBm. Connect signal generator to 8551 INPUT.

b. Set

851

VERT DISPLAY . . . . . LIN
I. F. BANDWIDTH 1MC
SWEEP TIME . . . . . 3 MILLISEC/CM
SYNC. . . . . LINE

8551

SIGNAL IDENTIFIER. . . . . OFF
SPECTRUM WIDTH . . . . . 200 MC/CM
ATTENUATOR(DB). 0
FREQUENCY(GC) 2-10
STABILIZATION. . . . . UNSTABILIZED

c. Adjust 8551 TUNE to center signal on 851 CRT, and set I. F. GAIN(DB) for 5-cm display and note I. F. GAIN setting.

d. Change signal generator output to -15 dBm.

e. Readjust I. F. GAIN for 5-cm display. The difference between 10 dB and I. F. GAIN change is the signal compression. (Signal compression should not exceed approximately 1 dB.)

Note

Signal compression is generally worst at low LO frequencies; however, if a more comprehensive test is desired, the above procedure can be followed at any frequency.

f. In a similar manner, check signal compression of waveguide mixers. Set generator output at -15 dBm, and choose a frequency such that the LO is tuned as near as possible to 2 Gc.

5-30. FREQUENCY RESPONSE.

Specification:

Coaxial Input:

Frequency Range	Mixing Mode n*	I. F.	Flatness Full Range	Flatness 100 Mc
10.1-100 Mc	1^-	2 Gc	±2.0 dB	±2.0 dB
100 Mc-1.8 Gc	1^-	200 Mc	±1.5 dB	±1.0 dB
1.8-4.2 Gc	$1^\pm$	2 Gc	±3.5 dB	±2.0 dB
2.4-4.1 Gc	2^-	2 Gc	±2.5 dB	±2.0 dB
4.1-6 Gc	1^+	2 Gc	±1.5 dB	±1.0 dB
6-8 Gc	3^-	2 Gc	±2.0 dB	±1.5 dB
8-10 Gc	2^+	2 Gc	±2.0 dB	±1.5 dB
10-12.0 Gc	3^+	2 Gc	±3.5 dB	±2.0 dB

*n = harmonic number

Note

The Relative Gain column shown under Frequency Response in Table 1-1 is not a specification; it is operating information which should prove helpful when using the analyzer. The relative gain figure varies from analyzer to analyzer; typical variation is within ±3 dB, though it may be greater. Procedure for obtaining the relative gain figure for your analyzer is given in Paragraph 2-23.

Table 5-8. Frequency Response Check Data

Signal Source	°Input Freqs (Gc)	8551 Settings				Approx Rel** Gain (dB)
		FREQ(GC) Range	SPEC. WIDTH (MC/CM)	TUNE (Gc)	Limits (dB p-p)	
608C/E	10.1 to 100 Mc	.01-2/4-6	10	0.05	4	0 ±2
608C/E 612A 8614A*	100 Mc to 1.8	.01-2/4-6	200 10	1.0	2 2	0 ±1
8616A*	1.8 to 4.2	1.8-4.2	200 10	2.8-3.2‡	7 4	0 ±3.5
8616A*	2.4 to 4.1	2-10	200 10	3.0	5 2	-7 ±2.5
618B	4.1 to 6.0	.01-2/4-6	200 10	3.0-5.0‡	2 2	0 ±1
618B 620A	6.0 to 8.0	4-12.4	200 10	7.0	4 2	-11 ±2
620A‡‡	8.0 to 10.0	2-10	200 10	9.0	4 2	-7 ±2
8690	10 to 12.4	4-12.4	200 10	11.2	7 4	-12 ±3.5

°Manually swept
*Leveled CW output
‡Vary TUNE setting as required to keep display on CRT
**Relative displayed amplitudes of equal-amplitude input signals for the various harmonic mixing modes. Figures given are approximate; ±3 dB is typical, variation can be greater. If figure-of-merit was established for relative gain (see Paragraph 2-23), check against figure-of-merit for your instrument instead of figures in approximate relative gain column.
‡‡Calibrated. 10-dB fixed attenuator inserted between 620A and 8551.

5-31. EQUIPMENT REQUIRED.

a. For the coaxial-input response measurement, signal generators with flat frequency-response characteristics are desirable. Generators with leveled output are available in the 10.1-Mc to 12.4-Gc range. Sweep oscillators with leveling capability (such as the HP 8690 series) may be used if available.

b. VHF Signal Generator (608C/E/F) (10 to 420 Mc): item 8 in Table 5-1.

c. UHF Signal Generator (612A) (450 to 800 Mc): item 32 in Table 5-1.

d. UHF Signal Generator (8614A) (0.8 to 1.8 Gc): item 11 in Table 5-1.

e. UHF Signal Generator (8616A) (1.8 to 4.2 Gc): item 19 in Table 5-1.

f. SHF Signal Generator (618B) (3.8 to 7.6 Gc): item 20 in Table 5-1.

g. SHF Signal Generator (620A) (7 to 10 Gc); item 18 in Table 5-1.

h. SHF Sweep Oscillator (8690) (with 8 to 12.4 Gc RF Unit): item 31 in Table 5-1.

i. Power Meter and Thermistor Mount (431B and 478A): item 15 in Table 5-1.

j. Coaxial cable terminated with Type N male connectors (11500A): item H in Table 5-2.

k. Adapter, Type N female to Type N female connector (UG-29B/U): item ZA in Table 5-2.

5-32. PROCEDURE.

a. Set

SYNC. . . . . LINE
I.F. BANDWIDTH 1MC
SWEEP TIME . . . . . 3 MILLISEC/CM
I.F. GAIN(DB) . . . . . 0 + about 50
VERT DISPLAY . . . . . LIN
ATTENUATOR(DB). 10
STABILIZATION. . . . . UNSTABILIZED
SIGNAL IDENTIFIER. . . . . OFF
SPECTRUM WIDTH VERNIER. . . . . CAL

b. Referring to Table 5-8, connect appropriate signal generator to 8551B INPUT and check peak-to-peak variation of displayed signal across each band. (Peak-to-peak variation should not exceed limits shown in Table 5-8.)

5-33. LO (BWO) RESIDUAL FM CHECK.

Specification:

Phase-locked: 1 kc peak-to-peak or less

Not phase-locked: typically less than 40 kc peak-to-peak.

5-34. EQUIPMENT REQUIRED.

a. Frequency Comb Generator (8406A): item 14 in Table 5-1.

b. Coaxial cable terminated with Type N male connectors (11500A): item H in Table 5-2.

5-35. CALIBRATION.

a. Set

8551

SPECTRUM WIDTH . . . . . 1 MC/CM
SPECTRUM WIDTH VERNIER . . . . . .CAL
SIGNAL IDENTIFIER . . . . . .OFF
FREQUENCY(GC). 01-2
STABILIZATION . . . . . UNSTABILIZED
ATTENUATOR(DB) 10

851

VERT DISPLAY . . . . . .LOG
I. F. BANDWIDTH. 10KC
I. F. GAIN . . . . . about 50
SWEEP TIME . . . . . 3 MILLISEC/CM

b. Set frequency comb generator for 1MC; connect to 8551 INPUT.

c. At analyzer, perform stabilization procedure (Figure 3-4).

d. Adjust TUNE so the 10 1-Mc signals on the display align with the 10 vertical axes on the 851 CRT graticule.

e. Turn SPECTRUM WIDTH VERNIER ccw, expanding scale until only 2 signals are displayed, exactly 10 cm apart. (SPECTRUM WIDTH calibration is now reduced to 0.1 of the value shown at any position designation.)

f. Leave generator set for 1MC and connected to 8551.

5-36. RESIDUAL FM CHECK, STABILIZED.

a. Set

SPECTRUM WIDTH . . . . . 10 KC/CM*
I. F. BANDWIDTH 1KC
SWEEP TIME . . . . . 1 SEC/CM
*Is actually set to 1KC/CM by virtue of calibration

b. Center 1-Mc marker signal with TUNE, and measure total excursion. (Total excursion should be less than 1 kc.)

c. Return SPECTRUM WIDTH VERNIER to CAL.

5-37. RESIDUAL FM CHECK, UNSTABILIZED.

a. Make following changes in settings:

I. F. BANDWIDTH. 3KC
SWEEP TIME . . . . . 3 MILLISEC/CM
STABILIZATION . . . . . .UNSTABILIZED
Frequency Comb Generator . . . . . 10 MC

b. Center signal with TUNE, and adjust I. F. GAIN (DB) for convenient display.

c. Set SWEEP TIME to .1 SEC/CM.

d. Switch SPECTRUM WIDTH as necessary (probably to 10 KC/CM) to measure total signal excursion resulting from residual FM in BWO output. (Total excursion should be less than 40 kc.)

5-38. RESIDUAL RESPONSES.

Specification:

Less than -90 dBm referred to signal input on fundamental mixing (-85 dBm when LO (BWO) is within 60 Mc of 2 or 4 Gc).

5-39. EQUIPMENT REQUIRED. The residual response check could require signal sources which generate signals from 10.1 Mc to 12.4 Gc. Hewlett-Packard signal generators suitable for the purpose are listed in Table 5-4.

5-40. PROCEDURE.

a. Turn on analyzer (see Figure 3-3), using following settings:

FREQUENCY(GC). 01-2
SPECTRUM WIDTH VERNIER . . . . . .CAL
SPECTRUM WIDTH. . . . . 1 MC/CM
SIGNAL IDENTIFIER . . . . . .OFF
ATTENUATOR(DB) 10
I. F. BANDWIDTH. 10KC
SWEEP TIME . . . . . 3 MILLISEC/CM
VERT DISPLAY . . . . . .LOG
I. F. GAIN(DB) . . . . . .80 (max gain)

b. Perform stabilization procedure (see Figure 3-4).

c. Turn TUNE through its range watching for any display significantly above the noise; if any appears, determine its frequency.

d. Set up a -90 dBm display at the frequency of the residual. Assuming a 120-Mc residual, connect signal generator to 8551 INPUT, set output frequency at 120 Mc and output level at -80 dBm (leave 8551 ATTENUATOR(DB) set at 10). Reference signal should be adjacent to that of the residual; if necessary, readjust frequency (at signal generator) to bring reference display close to that of the residual.

e. Compare amplitude of residual with that of the reference. (If residual is of same or less amplitude than that of reference, residual response is within specifications.)

f. If a residual appears within 60 Mc of 2 or 4 Gc, compare its amplitude with that of an input signal of approximately the same frequency and a level of -85 dBm. (Leave ATTENUATOR(DB) at 10, and use -75 dBm input signal.)

g. Set FREQUENCY(GC) to 1.8 - 4.2, and repeat procedure.

5-41. BWO (LO) NOISE SIDEBANDS.

Specification:

Greater than 60 dB below CW signal level, 90 kc or more away from signal, using fundamental mixing.

5-42. EQUIPMENT REQUIRED. Signal source which generates 1-Gc signals, such as the HP 8614A Signal Generator.

5-43. PROCEDURE.

a. Perform steps 1-7 of initial operating procedure, Figure 3-3, using input signal of about 1 Gc and the following control settings:

FREQUENCY(GC)	.01-2
SPECTRUM WIDTH	30 KC/CM
SPECTRUM WIDTH VERNIER	CAL
I. F. BANDWIDTH	1KC
VERT DISPLAY	LOG
I. F. GAIN(DB)	70 (60 + 10)
BASE LINE CLIPPER	max ccw

b. Center display with TUNE, and at signal generator adjust signal level for 851 display 7 cm high.

c. Stabilize (see Figure 3-4).

d. At 3 cm from center line (90 kc from signal), noise display should be less than 1 cm high.

5-44. LO (BWO) OUTPUT.

Specification:

Typically greater than 20 mW.

5-45. EQUIPMENT REQUIRED.

a. Power Meter and Thermistor Mount (431B and 478A): item 14 in Table 5-1.

b. 20-dB Attenuator (8491A - Option 20): item 16 in Table 5-1.

5-46. PROCEDURE.

a. Connect a 20-dB RF attenuator to LO OUTPUT-TERMINATE IN 50 OHM connector on 8551 rear panel. Connect power meter and thermistor mount to attenuator (see Figure 5-3).

b. With 8551 LINE switch at ON, tune across full LO range. Power meter reading should be approximately 0.2 mW (or greater), indicating output of approximately 20 mW (or greater).

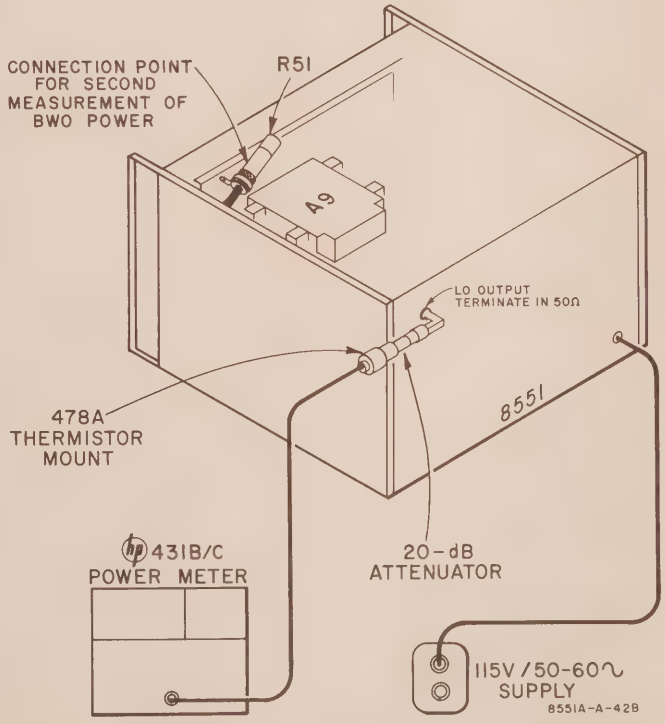


Figure 5-3. Setup for Measuring BWO Power at 8551 Rear Panel Output

Table 5-9. Schematic Location of Controls, Switches, Indicators, and Connectors, 8551B

Name	Ref Desig	Schematic	Figure No.
2GC IF INPUT	J4	RF Input	7-15
2GC OUTPUT	J3	RF Input	7-15
115/230 Slide Switch	S3	Primary Power	7-38
200 MHZ INPUT	J6	Converter	7-18
200 MHZ OUTPUT	J5	RF Input	7-15
ATTENUATOR (DB) switch	A1S1	RF Input	7-15
CONTROL connector	J9	Switching Logic	7-21
EXT MIXER INPUT	J2	RF Input	7-15
Fan Motor	B1	Primary Power	7-38
FREQUENCY (GC) switch	A11S1	RF Input Switching Logic Converter	7-15 7-21 7-18
FREQ. VERNIER	R56	10MC Osc/Disc.	7-26
FUSE	F1	Primary Power	7-38
IF OUTPUT	J7	Converter	7-18
INPUT	J1	RF Input	7-15
LINE switch	S2	Primary Power	7-38
LINE INPUT	p/o Z1	Primary Power	7-38
Line Voltage Slide Switch	S3	Primary Power	7-38
LO OUTPUT TERMINATE IN 50 OHM	J10	Sampler/Search Drive	7-29
OSC TRACK BALANCE meter	M1	Helix Control Input	7-32
PRESELECTOR DRIVE OUTPUT	J35	Helix Control	7-35
PRE STAB BAL control	A24R1	Sampler/Search Drive	7-29
REDUCE SPECTRUM WIDTH	DS3	Switching Logic	7-21
REF CHECK switch	A10S2	Converter	7-18
SENSITIVITY Control	R3	RF Input	7-15
SIG. IDENT CAL Adjustment	R55	Converter	7-18
SIGNAL IDENTIFIER Switch	A10S1	Converter	7-18
SPECTRUM CENTERING Adjust	R4	Helix Control Input	7-32
SPECTRUM WIDTH Switch	A12S1	Switching Logic, Helix Control Input	7-21, 7-32
SPEC WIDTH UNCAL lamp	DS4	Switching Logic	7-21
SPECTRUM WIDTH VERNIER	A12R8	Switching Logic	7-21
STABILIZATION Switch	A24S1	Switching Logic, Helix Control Input	7-21, 7-32
STAB. TUNE Adjust	R57	10MC Osc/Disc.	7-26
SWEEP INPUT	J8	Switching Logic	7-21
SWITCHED LINE OUTPUT	J34	Primary Power	7-38
TUNE Control	R5 R6 R7	Helix Control Input 10MC Osc/Disc. 10MC Osc/Disc.	7-32 7-26 7-26

INSTRUMENT SERIAL NUMBER _____

TABLE 5-10. PERFORMANCE CHECK TEST CARD

Procedures in this test card correspond
to Paragraphs 5-15 through 5-46.

Table 5-10. Performance Check Test Card, 8551B

Par. Ref.	Procedure	Min.	Act.	Max.
5-15	**1. SWEPT FREQUENCY LINEARITY:**			
	Spectrum widths 200 Mc/cm to 3 Mc/cm: Frequency error between display is less than ±10% ±3 Mc of the indicated frequency separation between the two points.			
	Spectrum widths 1 Mc/cm to 10 kc/cm (stabilized tuning mode): Frequency error between two points on the display is less than ±5% of the indicated frequency separation between the two points.			
	Equipment Required:			
	Frequency Comb Generator (8406A) Cable terminated with Type N male connectors (11500A) Analyzer Display Section			
5-17	Procedure, Stabilized:			
	a. Connect frequency comb generator to INPUT. Depress generator 1 MC control.			
	b. Set ATTENUATOR(DB) . . . . . .10 or 0 VERT DISPLAY . . . . . LOG I. F. GAIN(DB) . . . . . .70 + 10 SPECTRUM WIDTH . . . . . 1 MC/CM			
	c. Stabilize analyzer (Figure 3-4).			
	d. Turn TUNE through range observing displays.			
	e. Note number of marker intervals in 10-cm display.	9.5	_____	10.5
	f. Leave setup connected and analyzer turned on.			
	Procedure, Unstabilized: Turn TUNE through range, observing displays, as follows:			
	a. Set SPECTRUM WIDTH at 10 Mc; depress frequency comb generator 10Mc control.			
	b. Note number of intervals on 10-cm display.	8.7	_____	11.3
	c. Set SPECTRUM WIDTH at 100 Mc; depress frequency comb generator 100 Mc control.			
	d. Note number of intervals in 10-cm display.	9	_____	11
	e. Set SPECTRUM WIDTH at 200 Mc; depress frequency comb generator 100 Mc control.			
	f. Note number of intervals in 10-cm display.	18	_____	22

Table 5-10. Performance Check Test Card, 8551B (Cont.)

Par. Ref.	Procedure		Min.	Act.	Max.
	2. TUNING ACCURACY:				
	±1% of LO fundamental or harmonic				
	Equipment Required:				
	Power Meter & Thermistor Mount (431B & 478A) 20-dB Attenuator (8491A - Option 20) Cable terminated with Type N male connectors (11500A) Frequency Meter (536A)				
	a. Connect equipment to rear panel connector LO OUTPUT - TERMINATE IN 50 OHM, as indicated in Figure 5-2.				
5-22	b. No input signal required. Set: LINE . . . . . ON SPECTRUM WIDTH VERNIER. . . .max ccw STABILIZATION. . . . . UNSTABILIZED				
	c. Set TUNE for 2 Gc on LOCAL OSC FREQ scale. Adjust frequency meter for power meter dip.				
	d. Read frequency meter when power meter reading dips.	Gc	1.98	_____	2.02
	e. Turn TUNE to 2.2 Gc, and tune frequency meter for power meter dip.				
	f. Read frequency meter at power meter dip.	Gc	2.18	_____	2.22
	g. Set TUNE (Gc): 2.4 frequency meter reading at dip	Gc	2.37	_____	2.42
	2.6	Gc	2.57	_____	2.63
	2.8	Gc	2.77	_____	2.83
	3.0	Gc	2.97	_____	3.03
	3.2	Gc	3.17	_____	3.23
	3.4	Gc	3.37	_____	3.43
	3.6	Gc	3.56	_____	3.64
	3.8	Gc	3.76	_____	3.84
	4.0	Gc	3.96	_____	4.04
	3. SENSITIVITY:				
	See Paragraph 5-23.	dBm	-100	_____	

Table 5-10. Performance Check Test Card, 8551B (Cont.)

Par. Ref.	Procedure	Min.	Act.	Max.
	4. MAXIMUM INPUT POWER (FOR 1-DB COMPRESSION):			
	Coaxial Input ATTENUATOR Setting (dB) — Typical Max Input (Peak or Average (dBm)): 0 — -10 10 — 0 20 — +10 30 — +20 40 thru 60 — +30 Waveguide Input — Typical Max Input (Peak or Average (dBm)): 11521A (8.2-12.4 Gc) — -15 11517A (12.4-40.0 Gc) — -15 Equipment Required: VHF Signal Generator (608C/E/F) Power Meter & Thermistor Mount (431B, 478A)			
5-29	Check at 50 Mc a. With signal generator set for 50 Mc, calibrate output attenuator at -25, -15, and -5 dBm. Leave generator set for 50 Mc at -5 dBm. b. Connect calibrated signal generator to 8551 INPUT. c. Set VERT DISPLAY. . . . . LIN I. F. BANDWIDTH. . . . . 1 MC SWEEP TIME . . . . . 3 MILLISEC/CM SYNC . . . . . .LINE SIGNAL IDENTIFIER . . . . . .OFF SPECTRUM WIDTH. . . . . 1 MC/CM ATTENUATOR(DB) . . . . . 0 FREQUENCY(GC). . . . . .01-2 STABILIZATION . . . . . .UNSTABILIZED d. Center signal on CRT with TUNE; set I. F. GAIN for 5-cm display and note I. F. GAIN setting. e. Set signal generator to -15 dBm and reset I. F. GAIN for 5-cm display. Compression equals 10 dB minus the I. F. GAIN change. Signal Compression dB		_____	approx 1
	f. In a similar manner, check signal compression of external waveguide mixers. Initially, input signal should be at -15 dBm; choose a frequency such that LO is tuned as near to 2 Gc as possible. Signal Compression dB		_____	approx 1
	5. FREQUENCY RESPONSE: See Paragraph 5-30.			

Table 5-10. Performance Check Test Card, 8551B (Cont.)

Par. Ref.	Procedure	Min.	Act.	Max.
	6. LO (BWO) RESIDUAL FM:			
	Phase-locked - 1 kc peak-to-peak or less Not phase-locked - typically less than 40 kc peak-to-peak			
	Equipment Required: Frequency Comb Generator (8406A) Analyzer Display Section Cable (10503A) Adapter (UG-201A/U)			
	Connect frequency comb generator to INPUT, set generator for 1 Mc			
	Stabilize analyzer (Figure 3-4)			
	Calibrate SPECTRUM WIDTH to 0.1 (see Paragraph 5-35).			
5-36	Check, Stabilized			
	a. Set SPECTRUM WIDTH. . . . . 10 KC/CM (actually 1 kc/cm by calibration) I. F. BANDWIDTH. . . . . 1KC SWEEP TIME . . . . . .1 SEC/CM Frequency Comb Generator . . . 1 MC			
	b. Center signal with TUNE; measure total excursion kc		_____	1
5-37	Check, Unstabilized			
	a. Set I. F. BANDWIDTH 3KC SWEEP TIME 3 MILLISEC/CM STABILIZATION UNSTABILIZED Frequency Comb Generator 10 MC			
	b. Center signal on CRT, adjust I. F. GAIN for convenient display, and set SWEEP TIME to .1 SEC/CM.			
	c. Switch SPECTRUM WIDTH as necessary to measure signal excursion. kc		_____	40
5-38	**7. RESIDUAL RESPONSES (NO INPUT SIGNAL):**			
	Less than -90 dBm referred to signal input on fundamental mixing (-85 dBm when BWO is within 60 Mc of 2 or 4 Gc).			
5-40	a. Set FREQUENCY(GC). . . . . .01-2 SPECTRUM WIDTH. . . . . 1 MC/CM ATTENUATOR(DB) . . . . . 10 I. F. BANDWIDTH. . . . . .10KC SWEEP TIME . . . . 3 MILLISEC/CM VERT DISPLAY . . . . . LOG I. F. GAIN(DB) . . . . . 80 (max gain)			
	b. Turn TUNE through its range; if any display significantly above noise appears, determine frequency (Figure 3-5).			
5-40d	c. Apply signal from signal generator having same frequency as residual signal. Adjust signal generator output until its displayed signal is the same amplitude as the residual signal. Signal generatour output should be -90 dBm or less (-85 dBm or less if the frequency is within 60 Mc of 2 or 4 Gc).			

Table 5-10. Performance Check Test Card, 8551B (Cont.)

Par. Ref.	Procedure	Min.	Act.	Max.
5-41	**8. BWO NOISE SIDEBANDS:** Greater than 60 dB below CW signal level, 90 kc or more away from signal, using fundamental mixing. Equipment Required: 1-Gc Signal Source (8614A) Cable (11500A) a. Set FREQUENCY(GC). . . . . .01-2 SPECTRUM WIDTH. . . . . 30 KC/CM SPECTRUM WIDTH VERNIER . . . CAL I. F. BANDWIDTH. . . . . 1KC VERT DISPLAY. . . . . LOG I. F. GAIN . . . . . .70 (60 + 10) BASE LINE CLIPPER. . . . . max ccw b. Using input of about 1 Gc, perform initial operating procedure (Figure 3-3). c. Center display, and adjust input signal level for 7-cm display. d. Stabilize (Figure 3-4). e. Check height of noise level 3 cm from center line (i.e., 90 kc from signal). cm		_____	1
5-44	**9. BWO OUTPUT:** Typically greater than 20 mW. Equipment Required: Microwave Power Meter & Thermistor Mount (431B & 478A) 20-dB RF Attenuator (8491A - Option 20) Connect equipment to LO OUTPUT - TERMINATE IN 50 OHM connector on 8551 rear panel as indicated in Figure 5-3. With LINE at ON, power meter reading should be approximately 0.2 mW (or greater), indicating output of approximately 20 mW (or greater).			

5-47. COVER AND SIDE PANEL REMOVAL.

a. Equipment Required: Phillips screwdriver No. 2.

b. Top Cover Removal:

(1) Remove four Phillips head screws (6-32 x 7/16).

(2) Slide cover to rear and off instrument.

c. Side Panel Removal: After removing the top cover, remove from each panel the four Phillips head screws (6-32 x 3/16). The side panel lifts off.

d. Bottom Plate Removal:

(1) Remove the four Phillips head screws (6-32 x 7/16).

(2) Push plate to rear, and off instrument.

5-48. CHECK AND ADJUSTMENT TEST CARD.

5-49. Table 5-14 condenses the overall adjustment procedure. The test card is intended as an overall outline of 8551 adjustment procedures; reference is made to paragraph or table where additional information is given.

5-50. CHECKS AND ADJUSTMENTS.

5-51. Procedures for making adjustments in the 8551B are given in Paragraphs 5-52 through 5-105. It is recommended that procedures be performed in the order presented. Instructions for removal of cover plates are given in Paragraph 5-47. Allow at least a half-hour warm-up before making checks.

5-52. Power Supply Adjustments.

5-53. EQUIPMENT REQUIRED.

a. Variable Transformer; item 3 in Table 5-1.

b. DC Voltmeter (3440A): item 2 in Table 5-1.

c. AC Voltmeter (400D/H): item 22 in Table 5-1.

d. Cable assembly terminated with dual banana plugs (11000A): item A in Table 5-2.

e. Test leads, dual banana plug to alligator clips (11037A): item B in Table 5-2.

f. Small screwdriver.

5-54. SETUP (SEE FIGURE 5-4).

a. Rest 8551 on left side so both top and bottom of instrument are accessible.

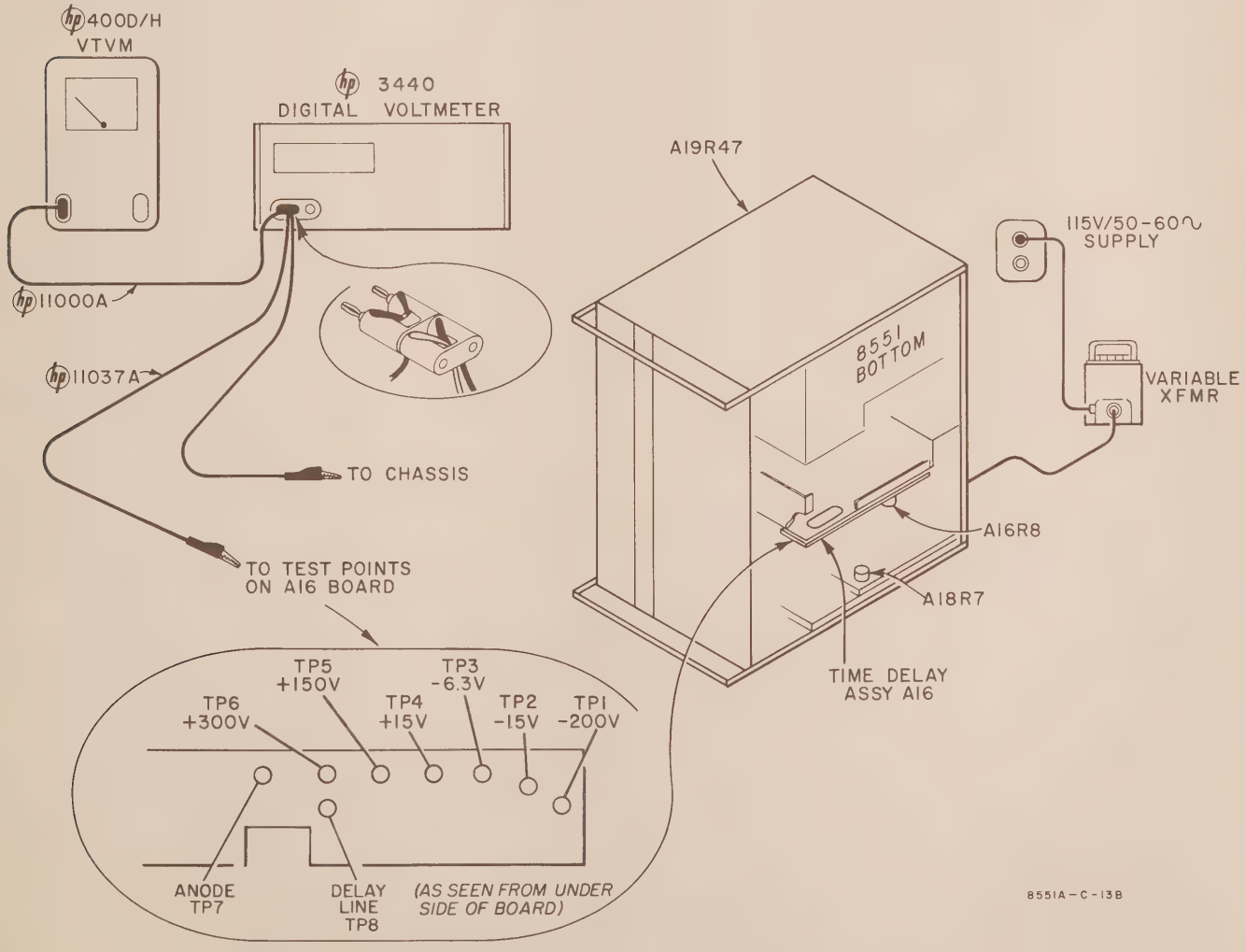


Figure 5-4. Measurement Setup, Low-Voltage Power Supplies

b. Remove top and bottom cover plates.

c. Check that 115/230 line voltage slide switch on rear panel is at 115.

d. Set variable transformer for 115-volt output and 8551 LINE to ON.

e. Refer to following Test Point and Adjustment Locator where necessary.

	Location	Access	Figure Refs
Supply Test Points	On HV TD Assy A16	Bottom of instr	7-3, 5-4
A16R8	On HV TD Assy A16	Bottom of instr	7-3, 7-33, 5-4
A18R7	On LV Rect Assy A18	Bottom of instr	5-4
A19R47	On LV Pwr Supply	Top of instr	7-2

5-55. LV POWER SUPPLIES.

a. +150 V Supply.

(1) Measure voltage from +150 V test point A16TP5 on HV TD Assy A16 to ground.

(2) Adjust potentiometers A19R47 for reading of +150.0 Volts* on dc voltmeter.

(3) Adjust variable transformer for 103.5 V line input.

(4) While watching both ac and dc voltmeters, slowly turn variable transformer up to 126.5 V line input. (Voltage should stay within 1.0 volt of 150 volts, and ripple should not exceed 0.7 mV rms.)

b. -200 V and +300 V Supplies.

(1) Make measurements at -200 V A16TP1 and +300 V A17TP6 test points, respectively.

*Note: If -200 or +300 V supplies are out of tolerance, the +150 V supply may be adjusted ±1 volt to get the other supplies within tolerance.

(2) Follow same procedure as for +150 V Supply. See Table 5-11 for permissible limits.

c. -6.3 V Supply. Measure from -6.3 V A16TP3 test point, and adjust potentiometer A18R7 to bring -6.3 V supply within limits given in Table 5-11.

d. Leave 8551 turned on and connected to voltmeters.

5-56. BWO ANODE SUPPLY.

5-57. HV POWER SUPPLIES.

a. Set TUNE to low-frequency stop at 2 Gc end of LOCAL OSC FREQ (F_{LO}) scale. Check that variable transformer is set for 115V.

b. Note anode voltage stamped on label side of BWO.

c. Measure voltage from ANODE test point A16TP3 on HV TD Assy A16 (Figure 5-4) to ground, and adjust A16R8 for anode voltage stamped on BWO.

5-58. BWO Frequency Calibration.

5-59. HELIX SWEEP-VOLTAGE LIMIT ADJUSTMENTS.

5-60. EQUIPMENT REQUIRED.

a. Frequency Comb Generator (8406A): item 14 in Table 5-1.

b. DC Voltmeter (3440A): item 2 in Table 5-1.

c. Test leads, dual banana plug to alligator clips (11003A): item U in Table 5-2.

d. Coaxial cable assembly terminated with Type N male connectors (11500A): item H in Table 5-2.

Table 5-11. Measurement Data, Low-Voltage Power Supplies, 8551

Supply	Adjust	115V Line (Vdc)	103.5V - 126.5V Line Regulation (max Vdc)	103.5V - 126.5V Line Ripple (max mV rms)
+150V	A19R47	+150.0	1.0	0.7
-200V		-200 ±2	1.0	0.4
+300V		+300 ±2	1.0	0.9
-6.3V	A18R7	-6.3 ±0.1	0.1	7.0

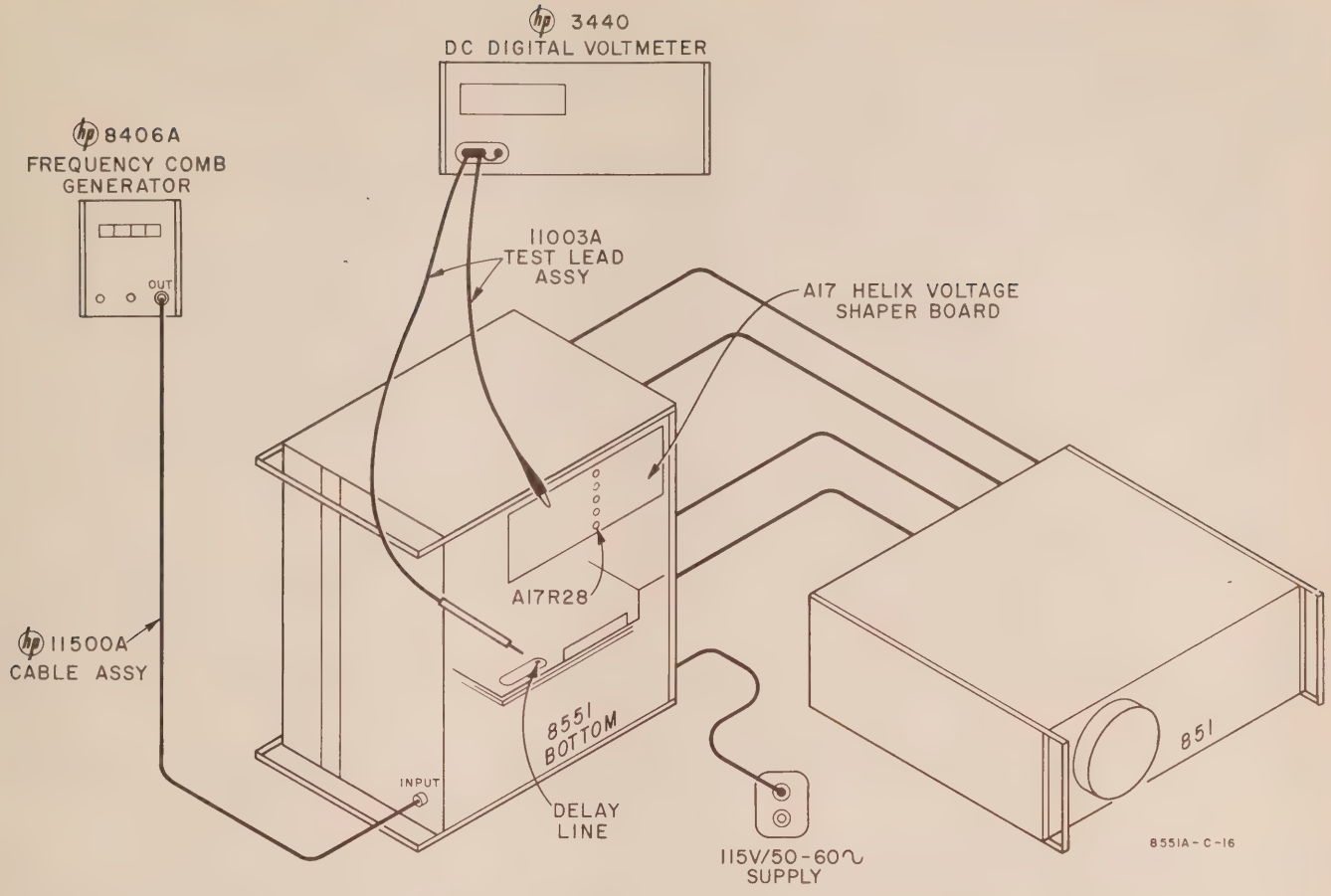


Figure 5-5. Measurement Setup, BWO Frequency Calibration, 8551

5-61. SETUP. See Figure 5-5. 8551 is resting on left side, and bottom plate is removed.

a. Set:

8551

FREQUENCY(GC)	.01-2
SPECTRUM WIDTH	100 KC/CM
SPECTRUM WIDTH VERNIER	CAL
TUNE	2.0 Gc on LOCAL OSC FREQ scale
LINE	ON

851

SWEEP TIME	3 MILLISEC/CM
SWEEP TIME VERNIER	CAL
I. F. BANDWIDTH	10KC
VERT DISPLAY	LOG
SYNC	INT
I. F. GAIN(DB)	0

b. Connect Frequency Comb Generator 8406A to 8551B INPUT. Depress 8406A 100MC pushbutton control. Output of frequency comb generator is frequencies spaced at 100 Mc which are used as markers in the calibration procedure.

5-26. PROCEDURE.

a. If the 2-Gc feed-through signal has not appeared on the display after a few minutes, readjust TUNE to find the 2-Gc signal. Adjust I. F. GAIN for a convenient display.

b. Adjust 2.0 - 2.2GC potentiometer A17R28 to center the 2.0-Gc response on the 851 CRT. A17R28 is on A17 Helix Voltage Shaper Board.

c. Connect voltmeter test lead ground clip to chassis, and probe to DELAY LINE A16 on HV TD Assy. Voltmeter indication is Helix Voltage V_1; record voltage V_1.

d. Set TUNE to 2.2 Gc on LOCAL OSC FREQ scale, and advance 851 I. F. GAIN until marker is visible. If necessary, readjust TUNE to center marker on 851 display. With voltmeter probe at DELAY LINE A16TP8, voltmeter indicates Helix Voltage V_2; record voltage V_2.

e. Calculate:

$$V = V_2 - V_1$$

$$E_1 = \frac{V_1 \times 10}{V}$$

$$E_2 = E_1 + 10$$

$$E_{10} = E_1 + 90$$

$$E_{11} = E_1 + 100$$

Table 5-12. Helix Sweep Voltage Limit Adjustments

TUNE Setting	Voltmeter Connection	Adjust	For
2.0 Gc	SHAPER (TP2)	**A13R12	Calculated E_1 volts
4.0 Gc	SHAPER (TP2)	**A13R10	Calculated E_{11} volts
Repeat in sequence until no adjustment change is necessary			
2.0 Gc	LOW (TP3)	*A17R36	Calculated E_2 volts
2.0 Gc	HIGH (TP1)	*A17R35	Calculated E_{10} volts
Repeat in sequence until no adjustment change is necessary			
*Figure 7-34		**Figure 7-30	

f. Measure and adjust voltages as indicated in Table 5-12.

g. Leave frequency comb generator turned on and connected to INPUT.

5-63. SPECTRUM CENTERING ADJUSTMENT.

a. Set
SPECTRUM WIDTH . . . . . 10 MC/CM
SWEEP TIME. . . . . 10 MILLISEC/CM
STABILIZATION . . . . . .UNSTABILIZED
I. F. BANDWIDTH 100KC

b. Set I. F. GAIN(DB) for convenient display, and center marker with TUNE.

c. Set SPECTRUM WIDTH VERNIER maximum ccw (zero sweep), and with a screwdriver turn SPECTRUM CENTERING adjustment to center OSC TRACK BALANCE meter.

d. To check, set SPECTRUM WIDTH VERNIER to CAL and, while watching the display, switch SPECTRUM WIDTH to 1 MC/CM; the display should not shift more than approximately a centimeter.

e. Return SPECTRUM WIDTH VERNIER to CAL.

f. Leave frequency comb generator turned on, set for 100MC, and connected to INPUT. Leave SPECTRUM WIDTH at 10 MC/CM.

5-64. HELIX VOLTAGE SHAPING.

5-65. See Table 5-13. At each setting of TUNE, adjust to center marker on 851 CRT. Permissible error limits are given for each setting of TUNE. In the case of the 2.0, 2.1, and 2.2 settings, adjust for best compromise for the three settings. To determine frequency error, note distance in cm that marker is from 851 CRT center line and multiply by 10 Mc (SPECTRUM WIDTH setting). (When marker is to right of center line, error is considered negative.)

5-66. Converter Adjustments.

Note

For routine adjustments, start at Paragraph 5-83. (Routine adjustments can be made without removing Converter cover.) Unless trouble is localized to Converter Assembly A9 and/or repair work has been done in A9, procedures in Paragraphs 5-67 through 5-76 need not be performed.

5-67. PREPARATION.

a. Remove top and right-side covers from 8551.

b. Locate Converter Assembly A9, top right-hand side of 8551 (see Figure 7-2); also locate 1800MC DRIVER OUTPUT Connector J25 (see Figure 5-8).

c. Remove the two machine screws that hold converter casting to mid-chassis support plate, and the three machine screws that hold converter assembly handle to 8551 side frame.

d. Remove converter top plate, it is secured to casting with 26 4-40 x 1/4" roundhead machine screws and No. 4 internal lockwashers. Remove RF gasket, which is across top of converter assembly. Place screws, washers, and gasket in safe place.

e. Turn on 8551, and set SIGNAL IDENTIFIER to OFF.

Table 5-13. Helix Voltage Shaping Adjustment Data

TUNE Setting (GC)	Adjust to center marker	Test Limits	
		Min.	Max
2.0	A17R28	1.98	2.02
2.1	A17R28	2.08	2.12
2.2	A17R28	2.18	2.22
2.4	A17R26	2.38	2.42
2.6	A17R23	2.58	2.62
2.8	A17R20	2.78	2.82
3.0	A17R17	2.97	3.03
3.2	A17R14	3.17	3.23
3.4	A17R11	3.37	3.43
3.6	A17R8	3.57	3.63
3.8	A17R5	3.77	3.83
4.0	A17R2	3.97	4.04

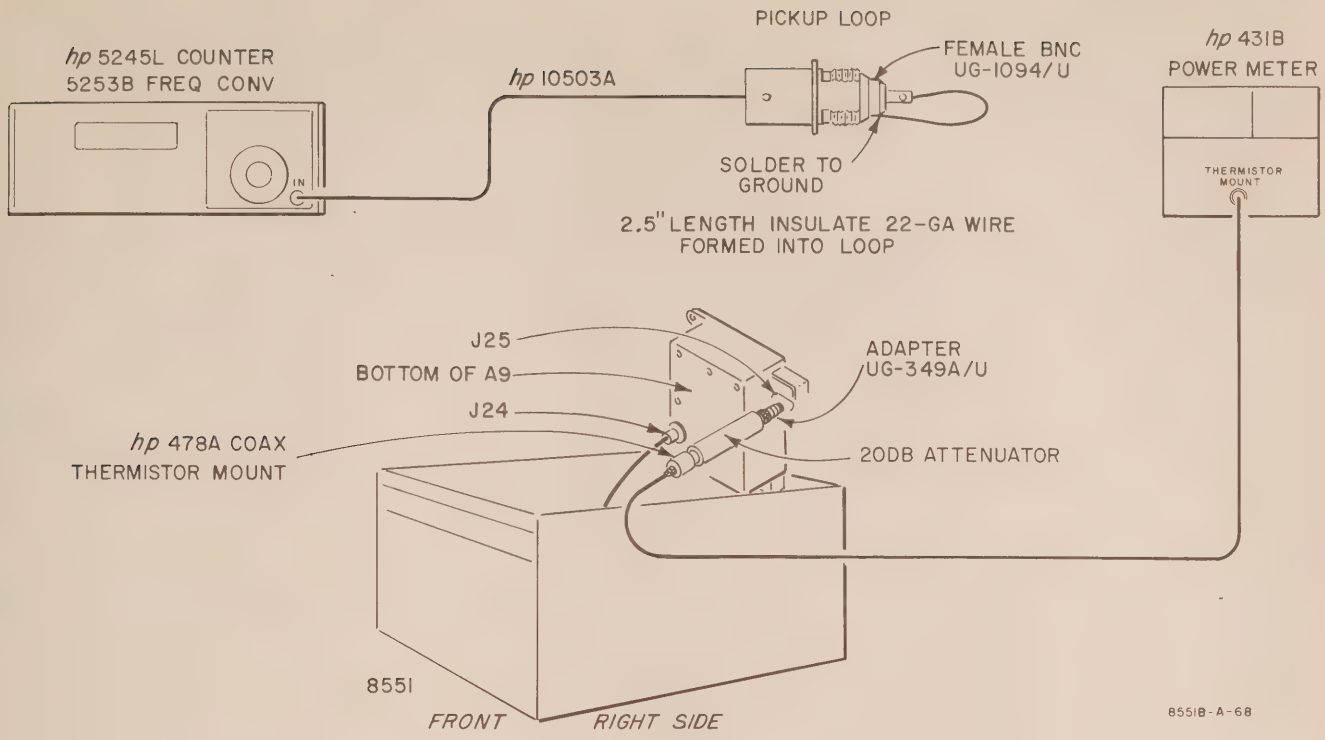


Figure 5-6. Setup for 180-Mc Adjustments

5-68. 180 MC OSCILLATOR AND BUFFER AMPLIFIER ALIGNMENT.

5-69. EQUIPMENT REQUIRED.

a. Electronic Counter (5245L): item 7 in Table 5-1.

b. Shielded coaxial cable terminated with BNC male connectors (10503A): item D in Table 5-2.

c. Pickup loop (see Figure 5-6): item AD in Table 5-2.

d. Modified; plastic tuning wand; item G in Table 5-2.

5-70. PROCEDURE.

a. Connect pickup loop (see Figure 5-6) to counter via Cable Assembly 10503A.

b. Set counter to take reading near 180 Mc.

c. Hold pickup loop just close enough to A9A3 board (Figure 5-8) to get a reading on counter.

d. With modified plastic tuning wand, tune 180MC OSC FREQ ADJUST A9A3C7 for 180 Mc ±50 kc.

Note

Preliminary adjustment of 180-Mc oscillator is for a frequency of 180 Mc ±50 kc. Final adjustment of oscillator is for a frequency of 180 Mc ±20 kc.

5-71. BUFFER AMPLIFIER POWER OUTPUT.

5-72. EQUIPMENT REQUIRED.

a. Equipment listed in Paragraph 5-69.

b. Power Meter and Thermistor Mount (431B): item 15 in Table 5-1.

c. Adapter, Type N female connector to BNC male connector (UG-349A/U): item AC in Table 5-2.

d. 20-dB Attenuator (8491A-Option 20): item 16 in Table 5-1.

e. Shielded coaxial cable terminated with BNC male connectors (10503A): item D in Table 5-2.

5-73. PROCEDURE.

a. Place converter assembly approximately as indicated in Figure 5-6 so both Connector J25 and boards in top of converter assembly are accessible.

b. Disconnect Cable W23 which connects to Connector J25. Connect adapter, 20-dB attenuator, and power meter thermistor mount to J25 as indicated in Figure 5-6.

c. Hold pick-up loop adjacent to A9A4T1 and, while monitoring amplifier frequency on counter, tune 180MC AMPLIFIER ADJUST A9A4C3 for maximum output as indicated on power meter; tune with modified plastic tuning wand.

d. Tune 180MC OSC FREQ ADJUST A9A3C7 for 180 Mc ±50 kc. Tune 180MC AMPLITUDE ADJUST A9A4C3 for maximum output. Output should be +18 dBm minimum (reading of -2 dBm on power meter).

5-74. 1800 MC DRIVER ADJUSTMENT.

5-75. EQUIPMENT REQUIRED.

a. Pickup loop; item AD in Table 5-2.

b. Electronic Counter (5245L): item 7 in Table 5-1.

c. Shielded coaxial cable terminated with BNC male connectors (10503A): item D in Table 5-2.

d. Milliammeter (412A): item 28 in Table 5-1.

e. Adapter, BNC female connector to banana plug (10111A): item E in Table 5-2.

f. Modified plastic tuning wand; item G in Table 5-2.

5-76. PROCEDURE.

a. Disconnect attenuator from Connector J25, and reconnect Cable W23.

b. Move converter assembly so connection between Cable W4 and Low-Pass Filter FL1 (Figure 5-7) can be reached. Disconnect Cable W4 from Filter FL1.

c. Using an adapter on Cable W4, connect milliammeter to Cable W4 (see Figure 5-7).

d. Tune 1800MC OUTPUT ADJUST A9A4C7 toward center of its tuning range for maximum current indication on milliammeter, and adjust 1800MC OUTPUT ADJUST A9A4R2 for 2.0 to 4.0 mA reading. Use modified end of plastic tuning wand to tune A9A4C7, and unmodified end to adjust A9A4R2.

Note

Since there is some interaction between A9A4C7 and A9A4R2, repeat the adjustments as required.

e. Hold pickup loop adjacent to A9A4T1, and check oscillator frequency on counter; if necessary readjust A9A3C7 for 180 Mc ±20 kc.

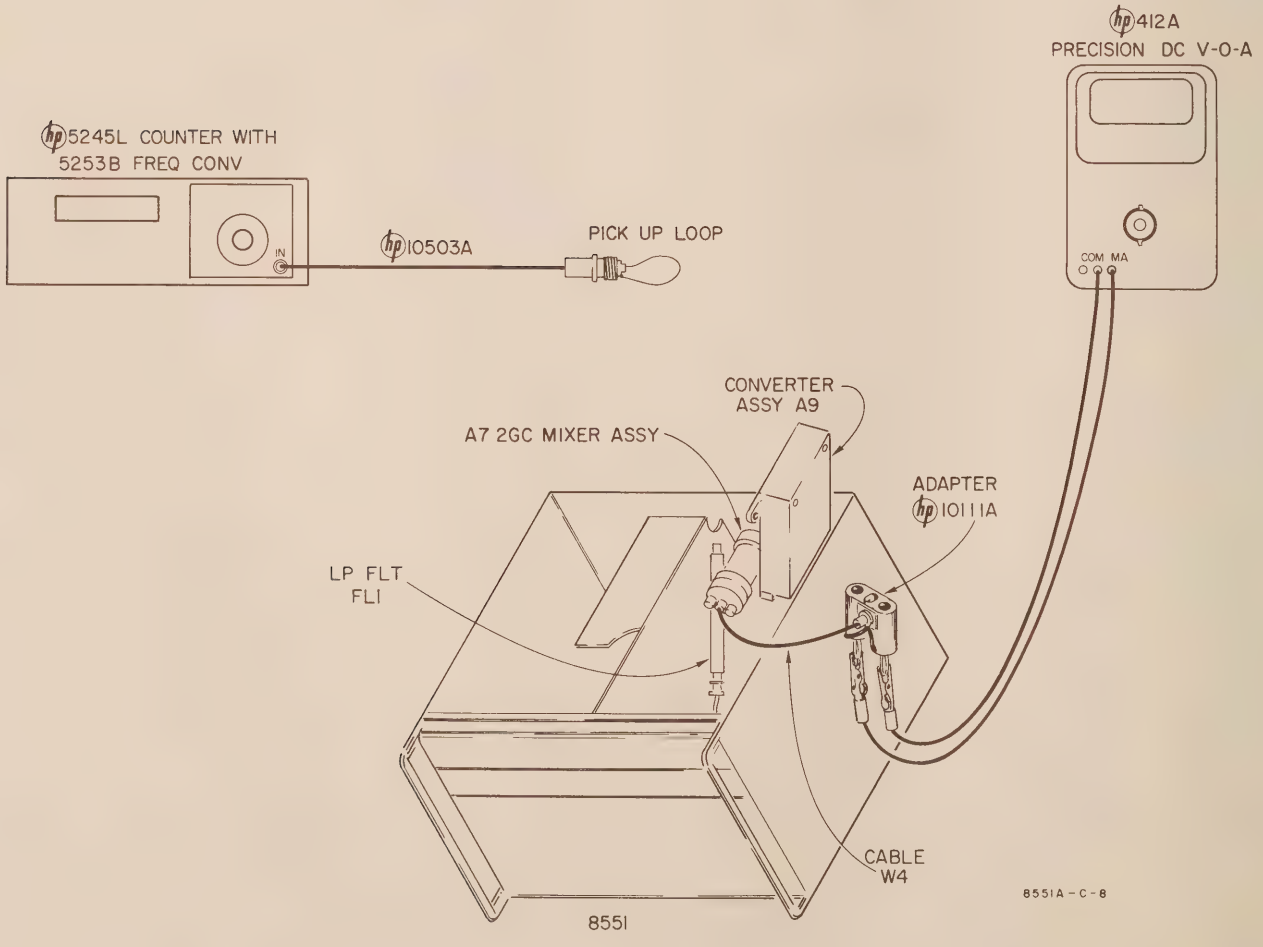


Figure 5-7. Setup for Measuring 180 MC Oscillator Frequency and Diode A7CR1 Current

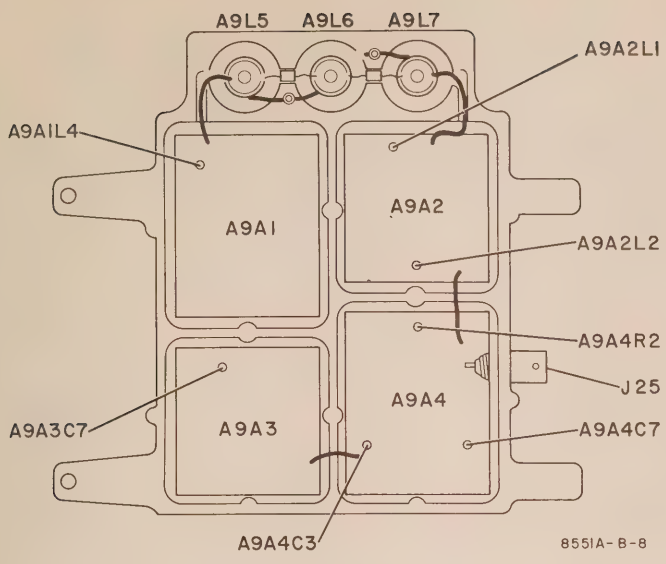


Figure 5-8. Location of Adjustments in A9 Converter Assembly

5-77. 200 - 20 MC MIXER ASSEMBLY TUNING.

5-78. EQUIPMENT REQUIRED.

a. VHF Attenuator (355D): item 10 in Table 5-1.

b. Shielded coaxial cable terminated with BNC male connector (10503A): item D in Table 5-2.

c. Adapter, BNC female connector to BNC female connector (UG-914/U): item Q in Table 5-2.

d. Walsco Tuning Wand (#2547): item M in Table 5-2.

e. Screwdriver.

5-79. MEASUREMENT SETUP. Setup is indicated in Figure 5-9. Required adjustments can be made with the converter cover plate either on or off.

a. Place converter so both the tuning slugs on the rear and the access holes in the cover plate are accessible.

(1) Remove buttons from access holes for 200MC AMPLITUDE TUNING L4 (A9A1L4), and 200MC OUTPUT ADJUST L1 and L2 (A9A1L1 and L2). (Walsco Wand should be used to adjust these inductors.)

(2) The tuning slugs which protrude from the rear of the converter assembly are located inside the form on which an inductor coil is wound. For simplicity in identifying the slug referred to, part designation for the inductor is used, though actually stray capacitance is adjusted as the tuning slug is turned, not inductance. Tuning slugs are identified in Figure 5-9. Tuning slugs are adjusted with a screwdriver; be careful not to jam tuning slug against bottom of coil form - coil form may break before slug can be loosened.

b. Connect a Model 355D Attenuator ahead of 2GC IF Amplifier Assy A5. A convenient place to make this connection is where Cable W1 connects to J15 on Coaxial Switch A4. This point is called out in Figure 5-9.

5-80. INITIAL PROCEDURE.

a. Set the Model 355D Attenuator to 30 dB.

b. Perform turn-on procedure, Figure 3-3, using following settings:

(1) 8551:

LINE . . . . . ON
SIGNAL IDENTIFIER. . . . . .OFF
SPECTRUM WIDTH . . . . . .100 KC/CM

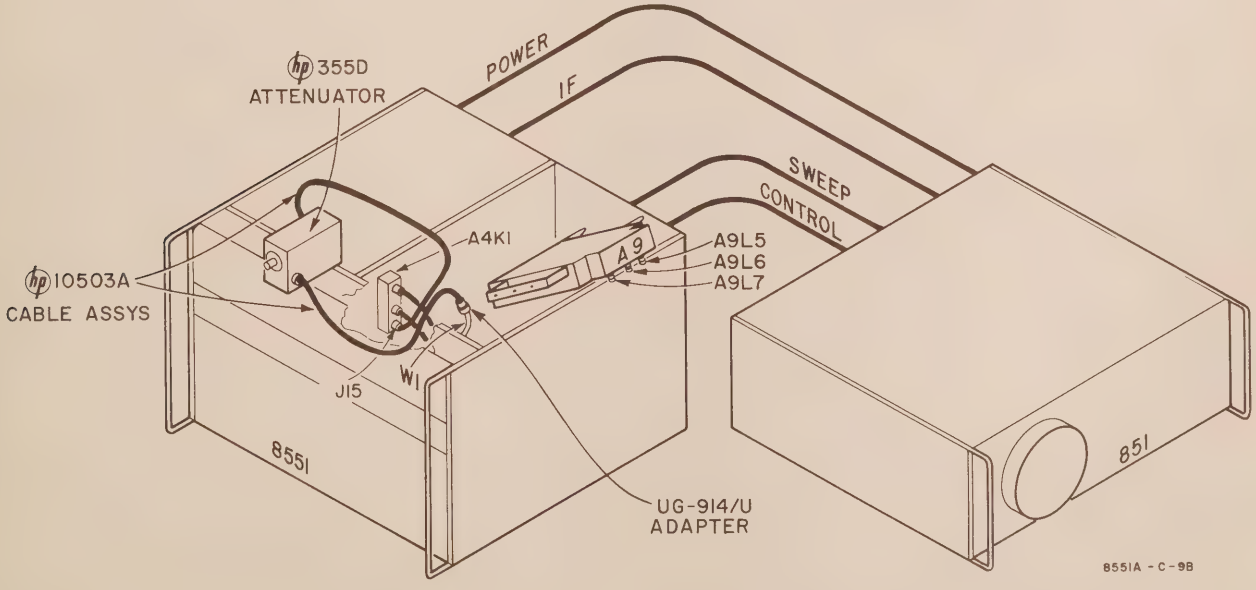


Figure 5-9. Setup for 200 - 20 Mc Mixer Assembly Adjustments

SPECTRUM WIDTH VERNIER. . . . . .CAL
FREQUENCY(GC) 01-2
STABILIZATION. . . . . .UNSTABILIZED
TUNE . . . . for reading of 2GC on LOCAL OSC FREQ (F_{LO}) dial

(2) 851:
BASE LINE CLIPPER . . . . . .max ccw
SYNC. . . . . LINE
I. F. BANDWIDTH 10KC
VERT DISPLAY . .SQ (most sensitive setting)
SWEEP TIME . . . . . 3 MILLISEC/CM
VERNIER. . . . . .CAL
INTENSITY . . . . . about 3 o'clock
I. F. GAIN(DB) . . . . . 60 dB

c. Adjust external 355D Attenuator and TUNE for 851 on-screen presentation.

d. Stabilize analyzer (see Figure 3-4). After stabilizing, return SPECTRUM WIDTH to 100KC/CM.

5-81. ADJUSTMENT.

a. VERT DISPLAY at SQ. Adjust A9L5, A9L6, and A9L7 (with screwdriver), and A9A1L4, A9A2L1, and A9A2L2 (with Walsco Wand) for maximum vertical deflection and best symmetry of 851 display.

Note

A9A2L1 and A9A2L2 interact.

b. Symmetry check, VERT DISPLAY at LOG.

(1) Set:
SPECTRUM WIDTH. . . . . .3 MC/CM
VERT DISPLAY. . . . . LOG
I. F. BANDWIDTH 1MC

(2) Adjust 355D Attenuator to obtain display with 60 dB vertical deflection.

(3) Adjust A9A2L1 and A9A2L2 to obtain best compromise between maximum vertical deflection and best symmetry.

5-82. FINAL TUNING, 180 MC OSC AND AMPLIFIER AND HARMONIC GENERATOR ASSY A6.

5-83. PROCEDURE. Setup is similar to that shown in Figure 5-7.

a. Replace RF gasket (removed in step d, Paragraph 5-67), converter casting top cover, and the 26 screws and washers which hold cover to casting; tighten screws tightly.

b. Access holes in casting covers are covered with push-in buttons. Pull out buttons on 180MC OSC FREQ ADJUST (A9A3C7) and 180 MC AMPLITUDE ADJUST (A9A4C3) access holes.

c. Compress pickup loop so it can be slipped into A9A4C3 hole, and retune A9A3C7 for 180 Mc ±20 kc; use modified GC plastic wand.

d. Remove pickup loop, and readjust A9A4C3 (with GC Wand) for maximum reading on milliammeter.

e. Repeat A9A3C7 and A9A4C3 adjustments until requirements of both steps c and d are met.

f. Replace buttons in access holes for A9A3C7 and A9A4C3, and remove buttons from 1800MC OUTPUT ADJUST A9A4C7 and A9A4R2.

g. Tune A6 FREQ ADJ (Figure 5-11) for maximum milliammeter reading.

Note

To tune A6, first loosen hex nut lock with a crowfoot wrench which has well insulated handle.

h. Using GC Wand, return A9A4C7 toward center of its maximum current tuning range, and readjust A9A4R2 for 2.0 to 4.0 mA reading on milliammeter.

5-84. FINAL TUNING, 200-20MC MIXER.

a. Use setup shown in Figure 5-9.

b. With cover on converter assembly, check tuning as detailed in Paragraphs 5-79 through 5-81. Only very slight adjustment will be required.

5-85. Sensitivity Adjustments.

5-86. Optimum adjustment of sensitivity requires special equipment (noise figure meter with 20-Mc input) that may not be available. Therefore this Manual also provides an alternate, though less accurate procedure (see Paragraph 5-92). Procedure given in Paragraph 5-82 must be performed before making sensitivity adjustments.

5-87. NOISE FIGURE MEASUREMENTS.

5-88. EQUIPMENT REQUIRED.

a. Noise Figure Meter (J16-340B) (20-Mc input): item 27 in Table 5-1.

b. Shielded coaxial cable terminated with BNC male connectors (10503A): item D in Table 5-2.

c. VHF Noise Source (343A): item D in Table 5-2.

d. Adapter, BNC male to BNC male connectors (UG-491A/U): item J in Table 5-2.

e. UHF Noise Source (349A): item 29 in Table 5-1.

f. Adapter, Type N male to BNC male connectors (UG-1034/U): item AF in Table 5-2.

g. 50-ohm Coaxial Termination (908A): item AG in Table 5-2.

h. Crowfoot wrench with well-insulated handle, for 7/16-inch hex nut; item A# in Table 5-2.

i. Adapter, Type N male to BNC female connectors (UG-201A/U): item L in Table 5-2.

j. 2 Gc IF Tuning Driver; item AH in Table 5-2.

k. Screwdriver.

5-89. CONVERTER 200-MC IF NOISE FIGURE.

a. Setup. See Figure 5-10.

(1) Disconnect external jumper cable from 200 MHZ OUTPUT, and connect 343A Noise Source to 200 MHZ INPUT.

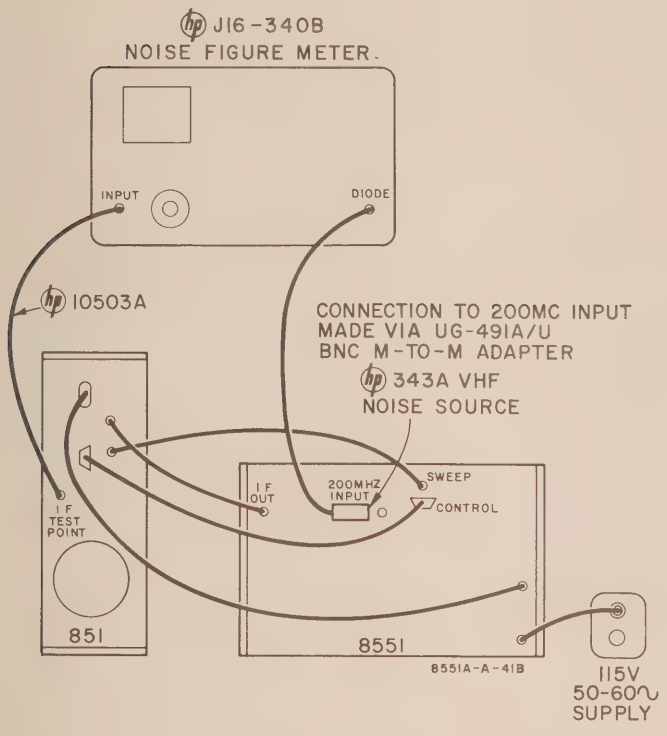


Figure 5-10. Setup, 200-Mc IF Noise Figure Measurement

(2) Connect 8551 to 851, and noise figure meter INPUT to IF TEST POINT on 851 rear panel.

(3) Set 8551 LINE to ON and check that SIGNAL IDENTIFIER is at OFF.

b. Procedure. Instructions given assume use of equipments shown in Figure 5-10. On J16-340B Noise Figure Meter:

(1) Set

INPUT	20 Mc
NOISE SOURCE	DIODE
NOISE FIGURE (rear panel)	.AUTO

(2) Switch METER FUNCTION to 4 mA, and adjust DIODE CURRENT to 3.31 mA.

(3) Measure noise figure:

(a) Switch METER FUNCTION to zero, and set meter to zero.

(b) Switch METER FUNCTION to INF, and set meter to INF.

(c) Switch METER FUNCTION to NOISE FIGURE and read meter. (Reading should be <6.5 dB.)

c. Disconnect 343A, and connect 200 MHZ INPUT to 200 MHZ OUTPUT. Leave noise figure meter connected to IF TEST POINT on 851 rear panel.

5-90. 2GC MIXER A7 NOISE FIGURE.

a. Setup. See Figure 5-11.

(1) Connect 349 UHF Noise Source to J16-340B Noise Figure Meter.

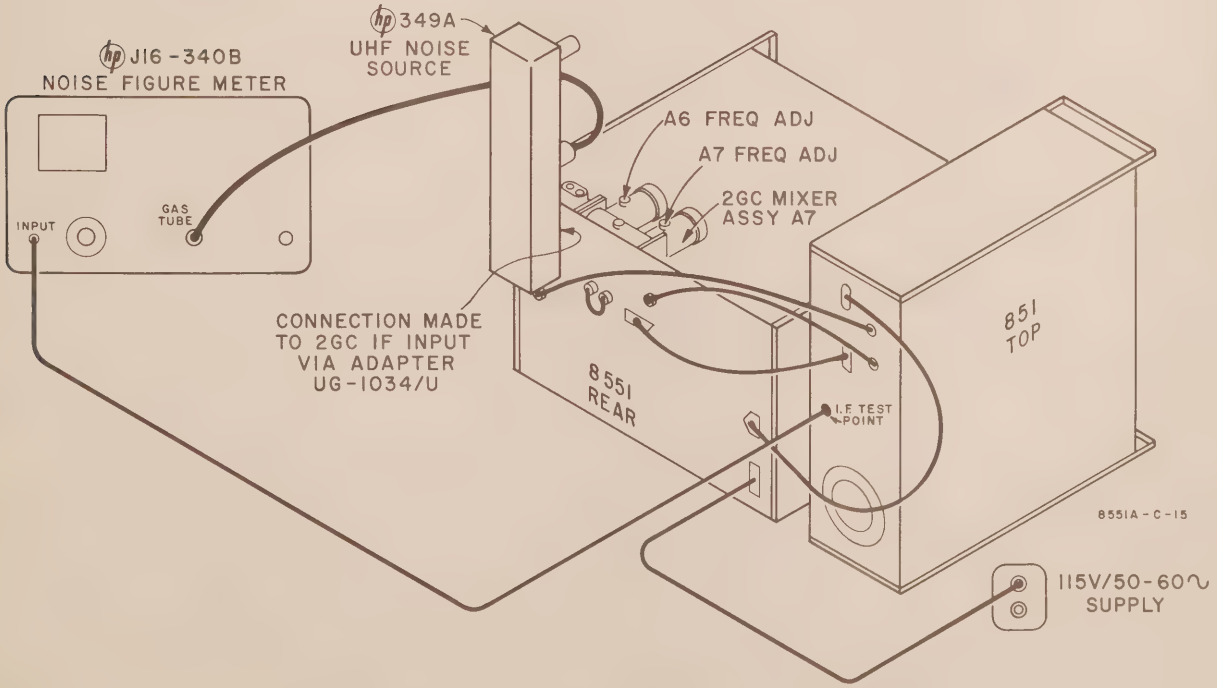


Figure 5-11. Setup, 2GC Mixer A7 Noise Figure Measurement

(2) Disconnect external jumper cable between 2GC I.F. INPUT and 2GC OUTPUT. Connect noise source to 2GC I.F. INPUT using Adapter UG-1034/U. Terminate noise source with 908A Coaxial Termination at 349A TERMINATION.

b. Procedure.

(1) Switch METER FUNCTION to GAS TUBE, and adjust GAS TUBE CURRENT to 150 mA.

(2) Measure NOISE FIGURE:

(a) Switch METER FUNCTION to zero, and set meter to zero.

(b) Switch METER FUNCTION to INF, and set meter to INF.

(c) Switch METER FUNCTION to NOISE FIGURE, and read meter.

(3) Adjust for minimum noise figure.

(a) Loosen hex nut on A7 FREQ ADJ with a crowfoot wrench which has well-insulated handle.

(b) Tune A7 FREQ ADJ for minimum noise figure. (Noise figure should be < 17 dB.)

(c) Lock A7 FREQ ADJ.

(4) Disconnect 349A from 2GC I.F. INPUT, and reconnect 2GC I.F. INPUT to 2GC OUTPUT. Leave noise figure meter connected to noise source and 851 IF TEST POINT. Leave 908A Termination at 349A TERMINATION.

5-91. 2GC IF AMPLIFIER A5 NOISE FIGURE.

a. Rest 8551 on left side, and remove bottom cover.

b. Disconnect Cable W1 from connector J14 on Coaxial Mixer Assembly A3 (see Figure 5-12).

c. Connect Cable W1 to 349A Noise Source NOISE OUT connector; use a UG-201A/U (Type N male to BNC female) adapter to make the connection.

d. Measure noise figure (see Paragraph 5-90b, steps (1), (2). (Noise figure should be < 13 dB.)

e. If noise figure is more than 13 dB, tune the A, B and C FREQ ADJ tuning slugs. Use a 2 Gc IF Tuning Driver, and work from left to right, with FREQ ADJ A (see Figure 6-4) considered as the adjust farthest left. Figure 5-13 shows how to use the 2 Gc IF driver. Unlock the slug lock, adjust each tuning slug for minimum noise-figure indication on the noise figure meter, and lock each FREQ ADJ tuning slug as it is tuned. Repeat the tuning a second time for optimum results. (Noise figure should be ≤ 13 dB.

f. Disconnect noise source, and connect Cable W1 to Connector J14. Disconnect noise figure meter from 851.

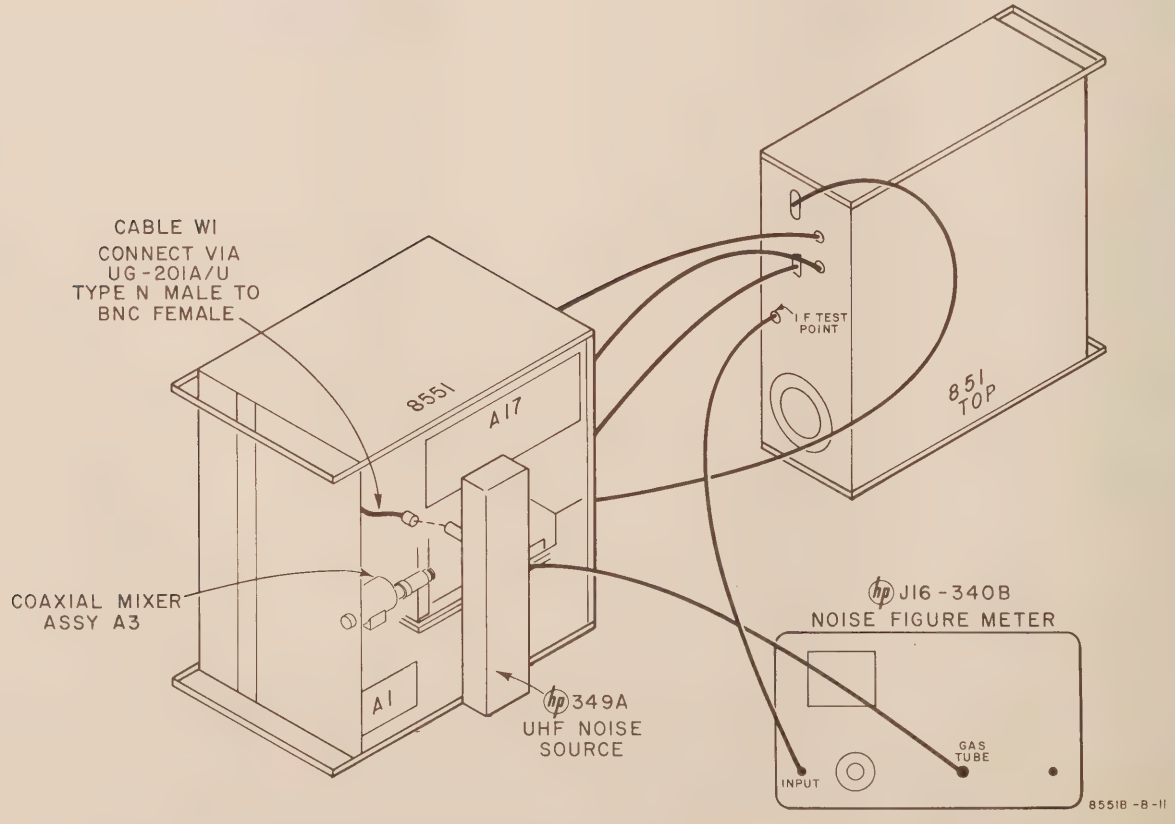


Figure 5-12. Setup, 2GC IF Amplifier A5 Noise Figure Measurement

5-92. ALTERNATE PROCEDURE FOR SENSITIVITY ADJUSTMENT.

5-93. PROCEDURE.

a. Connect convenient signal to 8551B INPUT and adjust controls to obtain signal on 851 CRT.

b. Tune A7 FREQ ADJ (Figure 5-11) and all three A5 frequency adjustments (starting with FREQ ADJ A - see Figure 5-13) for maximum signal amplitude on CRT. Use a crowfoot wrench with a well insulated handle to loosen the hex nut on A7.

Note

Although this procedure brings sensitivity within specifications, it may not give as good a result as the noise figure technique.

5-94. Phase-Lock Adjustments.

5-95. EQUIPMENT REQUIRED.

a. Oscilloscope (130C): item 1 in Table 5-1.

b. Digital Voltmeter (3440): item 2 in Table 5-1.

c. Electronic Counter (5245L): item 7 in Table 5-1.

d. Frequency Comb Generator (8406A): item 14 in Table 5-1.

e. BNC Tee (UG-274A/U): BNC male connector to 2 BNC female connectors; item F in Table 5-2.

f. 1000-ohm resistor.

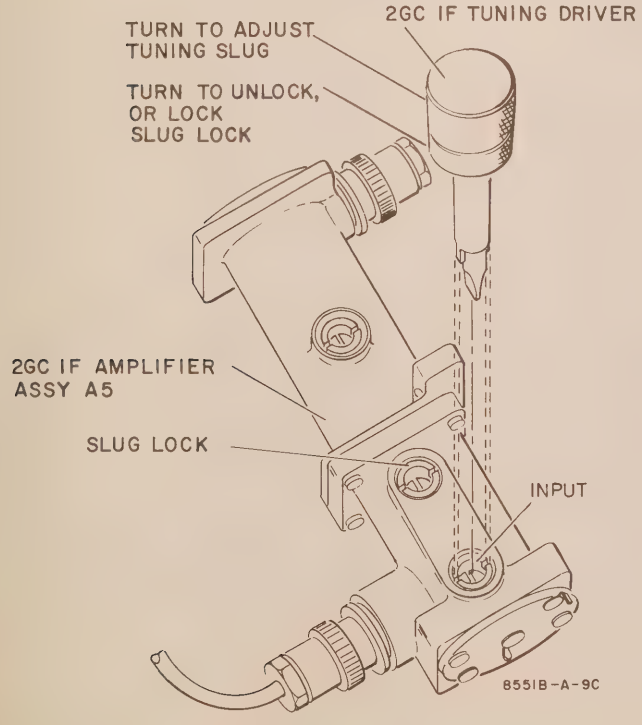


Figure 5-13. Using 2GC IF Tuning Driver

g. HF Signal Generator (606A/B): item 9 in Table 5-1.

h. UHF Signal Generator (8614A): item 11 in Table 5-1.

i. Screwdriver.

5-96. The phase-lock system adjustment can be determined by checking the phase-lock hold-in range and the 20- and 30-Mc residual signals. In the interest of keeping your maintenance time to a minimum, we recommend that you do not undertake the entire adjustment procedure unless absolutely necessary. The hold-in range tests are spelled out in steps at through ay; the 10- and 20-Mc filter tests, in steps bh and bi. If the results of both tests are within tolerance, no adjustment is required. If the hold-in range is out of tolerance, the entire procedure should be completed. If the residual signals only are out of tolerance, only that part of the procedure pertaining to the 10- and 20-Mc filters (steps bh through bn) need be completed; however, the lock assembly must be removed from the instrument (steps a through h) for access to the adjustments.

Lock Assembly Removal

a. Remove top and right side covers of 8551B; disconnect Cables W28 and W31 at Connectors J27 and J30 (see Figure 5-15).

b. Remove the 2 screws securing right handle assembly to chassis and remove handle.

c. Remove cable clamp securing Cables W28 and W31 to right side assembly.

d. Remove the 8 screws securing center section of right side assembly.

e. Remove Converter Assembly A9 to make room for removal of lock assembly (see Paragraph 5-67c). It may be necessary to disconnect the coaxial cables from the converter assembly.

f. Remove the 4 screws securing lock assembly base plate to chassis and work lock assembly free of instrument.

g. Install center section of right side assembly and secure with at least one screw. Reconnect cables to Converter Assembly A9 and secure converter assembly to chassis.

h. Position instrument on its left side and phase lock assembly on a piece of cardboard (or other insulating material) on the side frame of instrument (see Figure 5-14). Reconnect Cables W28 and W31 to Connectors J27 and J30.

Tracking

i. Using BNC tee, connect 851B sweep to SWEEP INPUT connector on 8551B and to horizontal input of oscilloscope.

j. On 8551B, set LINE to ON, FREQUENCY(GC) to .01-2, SPECTRUM WIDTH to 1 MC/CM, and STABILIZATION to UNSTABILIZED. Set TUNE to 2 Gc on LOCAL OSC FREQ scale, then push it in (to fine tuning position). Set STABILIZATION to STABILIZED.

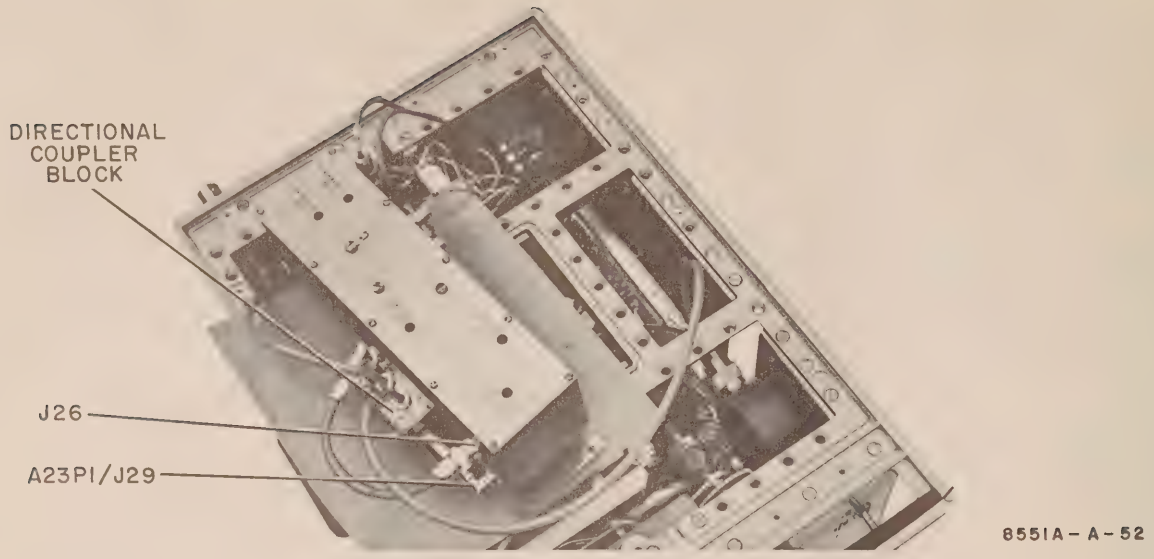


Figure 5-14. Lock Assembly A15 Ready for Adjustment

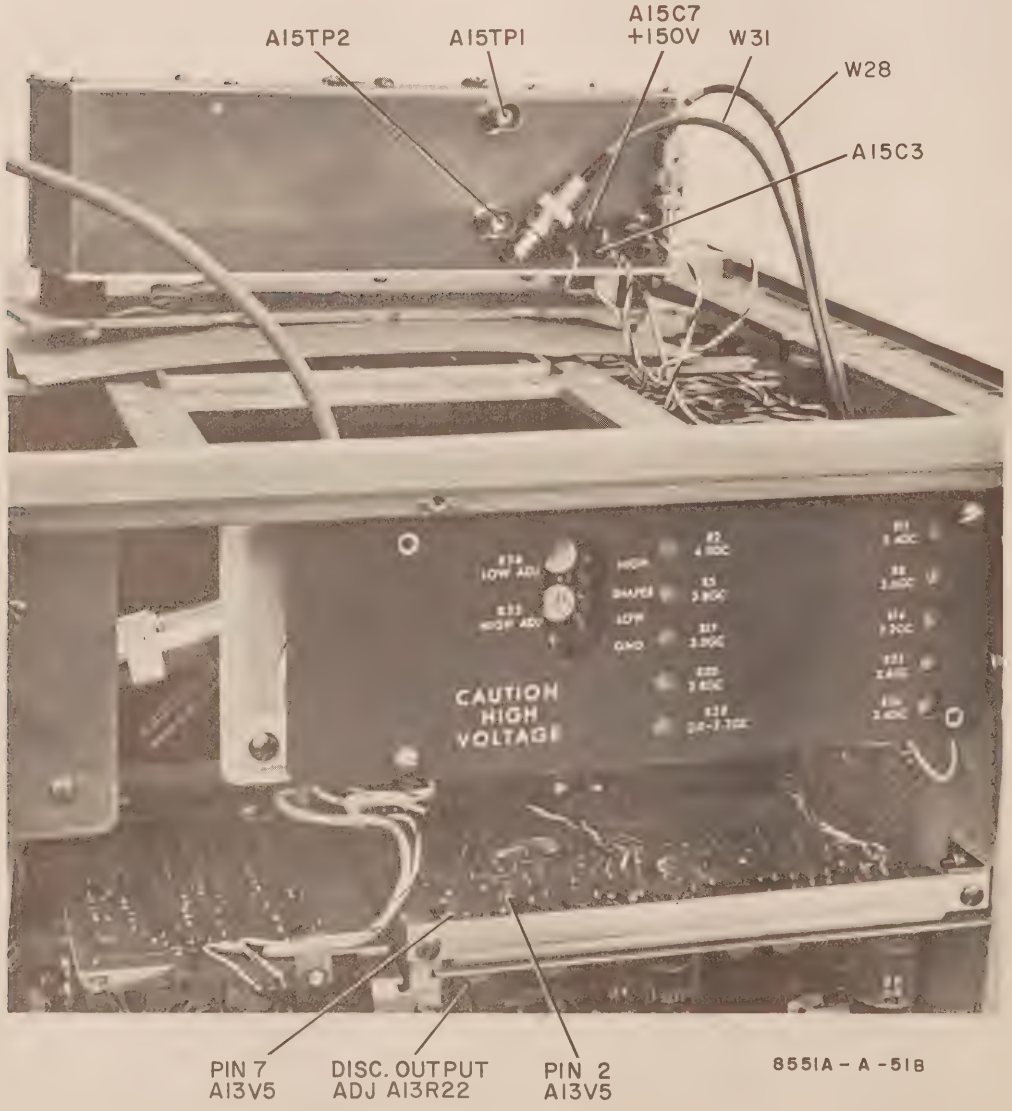


Figure 5-15. Test Points for Lock Assembly Adjustments

k. Adjust horizontal sensitivity on oscilloscope for a full 10-cm display. Set for DC BALANCED, DC-coupled input, and set sweep on center graticule line.

m. If A14R9 2:1 ADJ (Figure 7-27) was replaced as part of instrument repair, initially set TUNE to 4 Gc on LOCAL OSC FREQ scale, and adjust A14R9 for a resistance between 200 and 400 ohms; otherwise this initial adjustment of A14R9 is not required.

n. Connect oscilloscope vertical input to pin 2 of A13V5. (See Figure 5-15.)

o. Rotate TUNE and observe ramp on oscilloscope. Ramp should move about 0 V, jumping back at the completion of each revolution of TUNE. (A single turn potentiometer, R6, is coupled directly to the TUNE control. With each revolution of the TUNE control, R6 completes a cycle and starts over. The point at which the wiper arm of R6 leaves one end of the resistance material and picks up the other is the "step" and is referred to as such throughout this procedure.)

p. Set TUNE just counterclockwise of the step and adjust A14R4 RAMP ADJ so bottom of ramp just touches 0 V reference (see Figure 5-16).

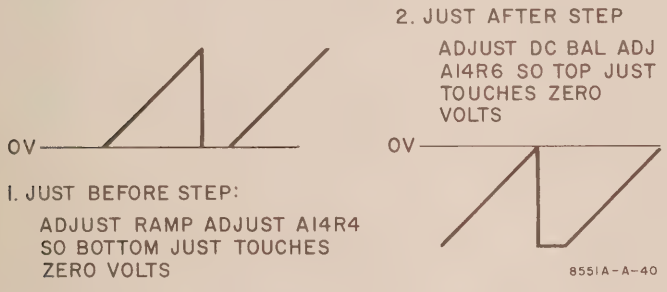


Figure 5-16. Adjustment of Sweep Ramp, Phase-Lock Circuit

q. Set TUNE just clockwise of the step and adjust A14R6 DC BAL ADJ so top or ramp just touches 0 V reference.

r. Set TUNE to BWO frequency of 2 Gc and adjust oscilloscope vertical sensitivity for a ramp amplitude of 10.0 cm.

s. Set TUNE to BWO frequency of 4 Gc (coarse tuning) can be used providing STABILIZATION switch is set to UNSTABILIZED position during coarse tuning) and adjust A14R9 2:1 ADJ for a ramp amplitude of 5.0 cm. Retune to BWO frequency of 2 Gc.

Differential Amplifier Balance

t. Disconnect sweep at 8551B SWEEP INPUT.

u. Short pins 2 and 7 (grids) of A13V5 to ground (see Figure 5-15).

v. Adjust A13R19 (Figure 7-30) for a voltage at A15C3 (sweep input to Lock Assembly A15; see Figure 5-15) +30 V above the +150-V supply (since the recommended digital voltmeter has only four digits, connect the voltmeter reference lead directly to +150 V for best resolution; A15C7 (Figure 5-15) is a convenient point to make this connection.)

CAUTION

Be sure to remove the shorting strap between the floating and chassis ground terminals of the voltmeter. If voltmeter used does not have floating input, measure voltages separately with respect to 8551B chassis.

Oscillator and Discriminator

w. Using BNC tee, connect counter to J26, 10-Mc output (Figure 5-17). Insert a 1k resistor at the tee in series with the cable to the counter to reduce loading effects of the cable.

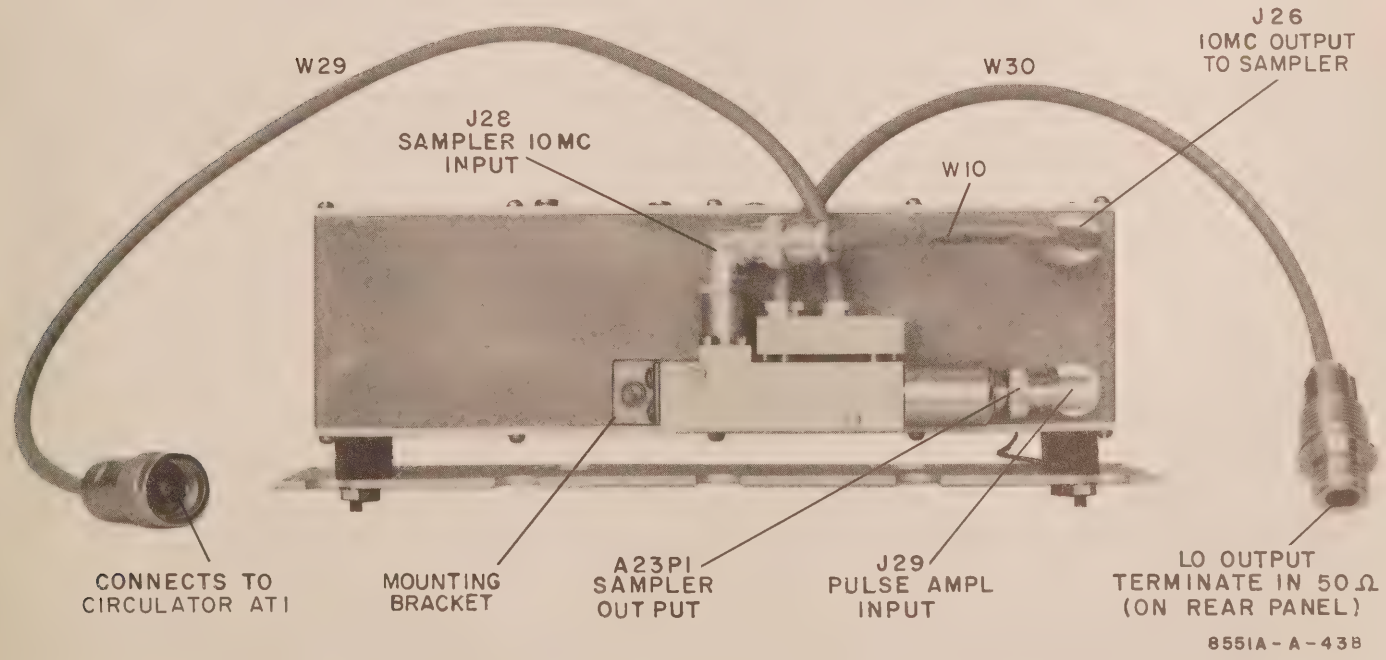


Figure 5-17. Lock Assembly A15 and Sampler Assembly A23, Model 8551B

x. Counter reading should be between 9.998 and 10.002 Mc; if necessary adjust A15A1C2 for proper reading.

y. Remove mounting screws securing Sampler Assembly A23 to Lock Assembly A15 and disconnect the two assemblies at A23P1/J29 (Figure 5-17). Connect dc voltmeter to A23P1 output of sampler assembly (first ground voltmeter probe to remove any possibility of static charge on the lead) and adjust A15A1T1 10MC AMPL OUTPUT TUNING for a maximum voltmeter reading.

z. Adjust A15A1C9 10MC AMPL INPUT LEVEL to the point where voltmeter reading approaches a plateau (amplifier begins to saturate). Do not overdrive the amplifier. Voltmeter reading should be between 0.9 and 2.5 V.

aa. Repeat steps x, y, and z. Then replace sampler.

ab. Remove short at pin 7 of A13V5.

ac. Counter reading should be between 9.998 and 10.002 Mc; if necessary adjust A15A1C21 for proper reading.

Note

If A15A1C21 is adjusted, again short grid 7 of A13V5 to ground, and recheck steps w through ac.

ad. Remove short at pin 2 of A13V5.

ae. Reconnect sweep to 8551B and connect 20-Mc IF OUTPUT from 8551B to 851B. Connect 1-Mc signal from frequency comb generator to 8551B INPUT and phase-lock analyzer on 1 Mc/cm spectrum width (push TUNE in for fine tuning).

af. Rotate TUNE to step point (if necessary reset STAB TUNE to make step point obvious) and note linearity of comb signal on 851B on each side of the step.

ag. Adjust A15A1C16 DISC PRIM ADJ for best compromise on both sides of the step.

ah. Repeat steps t through ac except make counter readings between 9.999 and 10.001 Mc. Remove short at A13V5, pin 2.

ai. Rotate TUNE one revolution at BWO frequency of 2 Gc; minimum counter reading should be between 0.974 and 0.976 Mc, and maximum reading should be between 10.024 and 10.026 Mc. If necessary, adjust STAB TUNE for proper readings. Remove counter.

Search Oscillator

aj. Set STABILIZATION to STABILIZED, and LINE to STANDBY.

ak. Center PRE STAB BAL control and adjust A14R21 balance potentiometer (Figure 5-27) to center OSC TRACK BALANCE meter. If necessary, first rotate A14R22 OSC GAIN potentiometer clockwise to stop meter fluctuations.

am. Readjust A14R22 OSC GAIN potentiometer counterclockwise just past point where meter fluctuations indicate search oscillator is oscillating.

Directional Coupler

Note

In the following steps, instructions for adjustment of Directional Coupler A23DC1 are included only for the case in which some repair has been made on the Sampler Assembly A23. Otherwise do not adjust A23DC1 until step az.

an. Set LINE to ON, STABILIZATION to UNSTABILIZED, pull TUNE control out for coarse tuning.

ao. Connect sweep from 851B to 8551B SWEEP INPUT and to oscilloscope horizontal input.

ap. Connect A15TP2 pulse amplifier output to oscilloscope vertical input and note the amplitude of beat-frequency signal and symmetry of upper and lower envelopes while tuning LO frequency from 2 to 4 Gc. Signal should be between 150 and 300 mV p-p.

aq. If necessary, reposition the coupling loop of A23DC1 Directional Coupler (see Figure 5-14) for proper signal amplitude (increase coupling to increase signal). Coupler block is pulled in (to increase coupling) by four corner screws and pushed out by four corner setscrews. Since the two sets of screws work against each other, loosen one set before tightening the other. After adjustment, use a gauge (such as a drill bit) to be sure spacing between the block and assembly body is the same all around.

ar. If upper and lower beat-note envelopes are not symmetrical, improve symmetry by readjusting A15A1C9 10MC AMPL INPUT LEVEL to reduce 10-Mc amplifier drive.

as. If A15A1C9 was readjusted, return LO to 2 Gc, remove sweep from 8551B, short pins 2 and 7 of A13V5 to ground, and repeat procedure from step v. Do not adjust A15A1C9 in step z except to obtain proper voltmeter reading.

Phase-Lock Hold-In Range

at. Stabilize (Figure 3-4) analyzer at 3.6 Gc on LOCAL OSC FREQ scale.

au. Rotate SPECTRUM WIDTH VERNIER fully counterclockwise (zero spectrum width) and slowly rotate PRE STAB BAL clockwise until OSC TRACK BALANCE meter jumps, indicating phase lock jumps to next 10-Mc harmonic.

av. Set LINE to STANDBY; measure and record dc voltage at pin 2 of A13V4.

aw. Return LINE to ON and rotate PRE STAB BAL counterclockwise until OSC TRACK BALANCE meter is centered again; continue rotating PRE STAB BAL counterclockwise until meter jumps again.

ax. Set LINE to STANDBY; again measure and record dc voltage at pin 2 of A13V4. The average of the absolute magnitudes of the two voltage readings should be less than 1.05 Vdc.

ay. Stabilize analyzer at 2.0 Gc on LOCAL OSC FREQ scale, and repeat steps au through ax. The average of the absolute magnitudes of the two voltage readings should be greater than 0.35 Vdc.

az. If voltmeter readings are out of tolerance, reposition coupling loop of A23DC1 Directional Coupler (see step aq) and repeat procedure from step at. If meter readings are low, increase coupling; if high, decrease coupling.

Tracking Accuracy at Step

ba. Recenter OSC TRACK BALANCE meter with PRE STAB BAL.

bb. Set SPECTRUM WIDTH VERNIER to CAL and SPECTRUM WIDTH to 100 KC/CM.

bc. Apply 1-Mc markers from frequency comb generator to 8551B INPUT.

bd. Rotate TUNE to the step and adjust STAB TUNE so marker shifts about 100 kc to the left on 851B CRT as TUNE is rotated clockwise through the step.

be. Tune to LO frequency of 4 Gc (to save time, use coarse tuning and relock at 4 Gc without adjusting STAB TUNE). Note marker shift as TUNE is rotated clockwise through the step; shift should be about 100 kc to the left.

bf. If necessary, readjust A14R9 2:1 potentiometer for proper shift.

bg. Remove frequency comb generator from 8551B INPUT.

10- and 20-Mc Filters

bh. Tune to low end of band and observe residual signals at 20 and 30 Mc on 851 CRT; compare each with signal from signal generator. Both should be -80 dBm or below. If so, phase-lock adjustments are completed.

bi. If signals are excessive, disconnect Cable W30 from Phase-Lock Assembly A15 at J30 (Figure 7-22), and recheck signal amplitudes. If signals remain excessive, see Paragraph 5-158. If signals are reduced to less than -85 dBm, adjust A15A4C29 10MC FLT ADJ and A15A4C28 20MC FLT ADJ per the following steps.

bj. Remove bottom cover from Lock Assembly A15 to gain access to filter adjustments; then, with all wires and cables connected to lock and sampler assemblies, turn 8551B on and tune to 10 Mc.

bk. Adjust A15A4C29 10MC FLT ADJ for minimum 10-Mc signal.

bm. Tune to 20-Mc signal and adjust A15A4C29 20MC FLT ADJ for minimum 20-Mc signal.

bn. Tune to 30 Mc and recheck amplitude of 30-Mc signal with signal generator. Compromise adjustment of 10- and 20-Mc filter adjustments may be required to minimize 30-Mc signal.

Noise Check

bo. Set

SPECTRUM WIDTH	30 KC/CM
ATTENUATOR(DB)	0
VERT DISPLAY	LOG
I. F. BANDWIDTH	1KC
SWEEP TIME	10 MILLISEC/CM
I. F. GAIN(DB)	70
FREQUENCY(GC)	2-10
TUNE	for 2.2 Gc on Frequency Scale

bp. Set Signal Generator 8416A for 2.2 Gc, and connect generator to 8551B INPUT. Stabilize (see Figure 3-4).

bq. At signal generator, adjust output for 7.0 cm display on 851 CRT. Noise sidebands should be 54 dB down, 90 kc away from center frequency; see Figure 5-18.

br. If noise is not within specifications:

(1) Check whether noise is generated in phase-lock loop or by circuits external to Lock Assembly A15 by switching STABILIZATION to UNSTABILIZED. If noise source is external to lock assembly, noise level will decrease slightly and frequency stability will deteriorate. See Table 5-21:6 and Paragraph 5-141.

(2) If noise source is within lock assembly, try readjusting 10MC AMPL INPUT LEVEL adjustment A15A1C9, and then recheck steps w through bq. If noise still is not within specifications, check Varicap A15A1CR1 (Figure 7-23) and Sampler Diode A23CR2 (Paragraph 5-214).

bs. Set

FREQUENCY(GC)	.01-2
TUNE	for 1.1 Gc on Frequency Scale
Signal Generator	for 1.1 Gc, 7.0 cm trace

bt. Stabilize analyzer (see Figure 3-4). Noise sidebands should be more than 60 dB below CW signal level; 90 kc or more away from center frequency when using fundamental mixing. (See Figure 5-18.)

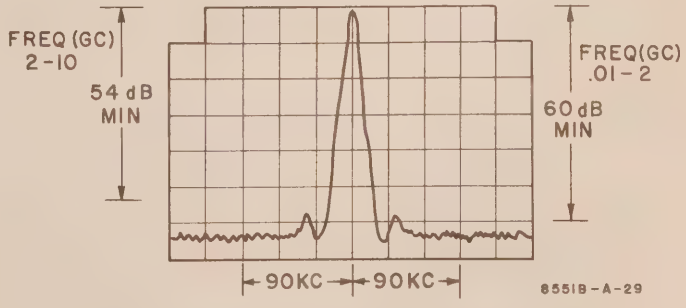


Figure 5-18. Limits, Lock Assembly Noise Sideband Check

bu. Set signal generator and TUNE for 1.9 Gc and repeat check.

bv. Replace lock assembly.

5-97. Adjustment of Resistors R59 &R60.

5-98. Variable Resistors R59 and R60 are used, respectively, to set 100MC/CM and 200MC/CM spectrum widths. R59 and R60 are mounted on a plate which is beneath the A14 Sampler Search Drive Assembly (see Figure 7-7); 200MC/CM Adjustment R60 is the potentiometer nearest the front panel. Unless a new A13 Helix Control Assembly is installed or Resistors A13R17 and/or A13R18 are replaced it is unlikely that Resistor R59 or R60 ever will require replacement.

5-99. PROCEDURE.

a. Set:

SYNC	.INT
VERT DISPLAY	LOG
I. F. BANDWIDTH	10KC
SWEEP TIME	10 MILLISEC/CM
I. F. GAIN(DB)	about 40 + 10
TUNE	.midband
SPECTRUM WIDTH	200 MC/CM
SPECTRUM WIDTH VERNIER	CAL
STABILIZATION	UNSTABILIZED
FREQUENCY(GC)	.01-2
ATTENUATOR(DB)	10
SIGNAL IDENTIFIER	OFF

b. Set 8406A for 100MC markers, and connect to 8551 INPUT. With LINE at ON, check that display base line is parallel to graticule; if not, adjust TRACE ALIGN. If display base is above graticule base line, adjust I. F. GAIN(DB) to position trace on 0.

c. Adjust R60.

(1) With TUNE, align a marker with graticule center line.

(2) Adjust R60 for optimum alignment of alternate markers with graticule 1-cm line.

d. Adjust R59.

(1) Switch SPECTRUM WIDTH to 100 MC/CM.

(2) With TUNE, align a marker with graticule center line.

(3) Adjust R59 for optimum alignment of markers with graticule 1-cm lines.

5-100. COUPLING OF BWO POWER TO COAX MIXER A3.

5-101. CHECK.

a. Set

SPECTRUM WIDTH VERNIER	max ccw (no sweep)
LINE	.STANDBY
TUNE	2 Gc on LOCAL OSC FREQ scale
FREQUENCY(GC)	.01-2

b. Measure A3 Mixer bias:

(1) Connect a dc voltmeter such as the 412A between bias terminal on Mixer Assembly A3 and chassis ground.

(2) If necessary, adjust potentiometer R1 on Bias Generator Assembly A25 for a voltage reading of 0.0 ±0.05 volts (see Figure 5-25).

(3) Disconnect the bias lead from Mixer A3 at A3C3 and connect the 412A current leads from the bias terminal on the mixer and to chassis ground.

(4) Set the 8551 LINE switch to ON. Allow at least a half-hour warmup before making check. TUNE from 2 to 4 Gc. Current reading on the 412A should be at least 0.150 mA.

c. Leave TUNE at minimum-current setting, and meter connected between mixer bias terminal and chassis ground.

5-102. ADJUSTMENT. Location of Coax Mixer A3 is shown in Figure 5-25, and directional coupler is identified in Figure 5-26.

a. Diode current can be increased by removing one of gaskets (A3MP11 Figure 5-26). Removal of more than one gasket may severely affect flatness from 8 to 12 Gc.

b. If trouble is experienced around 2.01 Gc, the current can be increased by lowering the frequency of the IF cavity. To lower the cavity frequency, turn the tuning screw (see Figure 6-3) in a clockwise direction.

Note

This is a compromise against mixer conversion loss and no more than 1/2 dB should be sacrificed (see Paragraph 2-19).

5-103. OSC TRACK BALANCE METER ZERO SET.

5-104. With the 8551 turned off, the OSC TRACK BALANCE meter is centered, and unless the instrument is subjected to severe mechanical shock, it is unlikely that the meter will ever have to be zero set. However, in the event the information ever should be required, instructions are given below.

5-105. Location of the meter assembly on the rear of the front panel is shown in Figure 7-4. Instructions for freeing the front panel are given in Paragraph 5-229.

a. Remove meter assembly from front panel. Note spacer washers, if any.

b. Remove tape dot from meter adjustment hole.

c. With pointed instrument such as a soldering tool, reposition adjustment fork to position pointer exactly at 0. (The soldering tool is listed as item T in Table 5-2.)

d. Stick tape dot over hole, and reinstall meter.

INSTRUMENT SERIAL NUMBER _____

TABLE 5-14. CHECK AND ADJUSTMENT TEST CARD

Procedures in this test card correspond to
Paragraphs 5-52 through 5-105.

Table 5-14. 8551B Check and Adjustment Test Card

Par. Ref.	Step	Operation			Record Min.	Act.	Max.
INSTRUMENT OFF							
	1	Mechanical and visual inspection			By _____		
5-104	2	OSC TRACK BALANCE meter zero set, if required					
INSTRUMENT ON							
5-52		**POWER SUPPLIES**					
		Power Supply Measurements; Setup: Figure 5-4.					
5-55	3	+150 V					
		a. Adjust A19R47		Vdc	+149.0	_____	+151.0
		b. 103.5-126.5 V line	Regulation	Vdc		_____	±1.0
			Ripple	mV rms		_____	0.7
	4	-200 V		Vdc	-198	_____	-202
		103.5-126.5 V line	Regulation	Vdc		_____	±1.0
			Ripple	mV rms		_____	0.9
	5	+300 V		Vdc	+298	_____	+302
		103.5-126.5 V line	Regulation	Vdc		_____	±1.0
			Ripple	mV rms		_____	0.9
	6	-6.3 V					
		a. Adjust A18R7		Vdc	-6.2	_____	-6.4
		b. 103.5-126.5 V line	Regulation	Vdc		_____	±0.1
			Ripple	mV rms		_____	7.0
5-57	7	**BWO ANODE VOLTAGE**					
		a. Set TUNE to low-frequency stop (max left)					
		b. Adjust A16R8 (Figure 5-4) for anode voltage stamped on BWO				_____	
5-58	8	**BWO FREQUENCY CALIBRATION**					
		Helix Sweep-Voltage Limit Adjustments; setup: Figure 5-5.					
		a. Set Frequency Comb Generator . . . . 100MC SPECTRUM WIDTH. . . . . 100 KC/CM TUNE . . 2 Gc on LOCAL OSC FREQ scale					
5-62		b. Find 2-Gc feed-thru signal.					

Table 5-14. 8551B Check and Adjustment Test Card (Cont.)

Par. Ref.	Step	Operation		Record Min.	Act.	Max.
		TUNE Setting — Adjust				
		c. 2.0 Gc — A17R28 to center 2-Gc feed-thru signal on 851 CRT				
5-62c		Measure Helix V_1:	Vdc		_____	
5-62d		d. 2.2 Gc — TUNE to center marker on 851 CRT				
		Measure Helix V_2:	Vdc		_____	
		e. Calculate:				
		$V = V_2 - V_1$	Vdc		_____	
		$E_1 = \frac{V_1 \times 10}{V}$	Vdc		_____	
		$E_2 = E_1 + 10$	Vdc		_____	
		$E_{10} = E_1 + 90$	Vdc		_____	
		$E_{11} = E_1 + 100$	Vdc		_____	
		f. Measure and adjust in accordance with Table 5-12				
5-63	9	R4 SPECTRUM CENTERING Adjustment				
		a. Set SPECTRUM WIDTH . . . . 1 MC/CM SWEEP TIME . . . 10 MILLISEC/CM STABILIZATION. . . UNSTABILIZED				
		b. Center marker with TUNE				
		c. Set SPECTRUM WIDTH to 10 MC/CM				
		d. Center marker with SPECTRUM CENTERING adjust				
		e. Set SPECTRUM WIDTH to 1 MC/CM. If display is not centered: Center with TUNE Check with SPECTRUM WIDTH at 10 Mc If necessary readjust SPECTRUM CENTERING				
		f. Repeat until display remains centered as SPECTRUM WIDTH is switched from 1 MC/CM to 10 MC/CM. Leave generator connected to INPUT.				
5-64	10	Helix Voltage Shaping				
		a. Set SPECTRUM WIDTH to 10 MC/CM. Adjust TUNE to center marker.				
		b. TUNE Setting (Gc) — To center marker adjust				
		2.0	Gc	1.98	_____	2.02
		2.1 — A17R28 - best compromise	Gc	2.08	_____	2.12
		2.2	Gc	2.18	_____	2.22
		2.4 — A17R26	Gc	2.38	_____	2.42
		2.6 — A17R23	Gc	2.58	_____	2.62
		2.8 — A17R20	Gc	2.78	_____	2.82

Table 5-14. 8551B Check and Adjustment Test Card (Cont.)

Par. Ref.	Step	Operation			Record Min.	Act.	Max.
		TUNE Setting (Gc)	To center marker adjust				
		3.0	A17R17	Gc	2.97	_____	3.03
		3.2	A17R14	Gc	3.17	_____	3.23
		3.4	A17R11	Gc	3.37	_____	3.43
		3.6	A17R8	Gc	3.57	_____	3.63
		3.8	A17R5	Gc	3.77	_____	3.83
		4.0	A17R2	Gc	3.97	_____	4.04
5-82	11	**CONVERTER AND HARMONIC GENERATOR ADJUSTMENTS**					
		a. Using setup shown in Figure 5-7, slip pickup loop into A9A4C3 hole, and adjust A9A3C7 for 180 Mc. Then adjust A9A4C3 for maximum milliammeter reading.		Mc	179.98	_____	180.02
		b. Adjust A6 FREQ ADJ (Figure 5-11) to peak milliammeter, adjust A9A4C7 toward center of maximum current range and adjust A9A4R2 for meter reading between 2.0 and 4 mA.		mA	2.0	_____	4
5-77		c. With setup of Figure 5-9, set SPECTRUM WIDTH. . . . . .100 KC/CM FREQUENCY(GC). . . . . .01-2 STABILIZATION . . . . .UNSTABILIZED TUNE . . . . . .2 Gc (for signal on CRT) SYNC . . . . . LINE I. F. BANDWIDTH. . . . . 10KC VERT DISPLAY . . . . . SQ SWEEP TIME . . . . . 3 MILLISEC/CM					
		d. Adjust A9L5, A9L6, A9L7, A9A1L4, A9A2L1, and A9A2L2 for maximum vertical deflection and best symmetry of 851 display.					
5-85		**SENSITIVITY**					
5-89	12	Converter A9 200MC IF Noise Figure (NF) Measurement; Figure 5-10.					
		a. Connect J16-340B NF Meter to IF TEST POINT on rear of 851, and 343A Noise Source to 8551 200 MHZ INPUT.					
		b. Measure noise figure.		dB		_____	6.5
		c. Leave NF meter connected.					
5-90	13	2GC Mixer A7 NF Measurement; Figure 5-11.					
		a. Connect 349A Noise Source to 2GC IF INPUT					
		b. Tune A7 FREQ ADJ for minimum NF		dB		_____	17
		c. Lock A7 FREQ ADJ					
		d. Leave NF meter connected.					

Table 5-14. 8551B Check and Adjustment Test Card (Cont.)

Par. Ref.	Step	Operation	Record Min.	Record Act.	Record Max.
5-91	14	2GC IF AMPL A5 NF Measurement; Figure 5-12.			
		a. Connect 349A Noise Source to Cable W1.			
		b. Measure NF. dB		_____	13
		c. Connect Cable W1 to J15 on Coax Mixer A3.			
		d. Disconnect NF meter from 851.			
5-92	15	Alternate Sensitivity Adjustment.			
		a. Perform step 11 above.			
		b. Connect signal between 10.1 Mc and 1.8 Gc with an amplitude less than -15 dBm to INPUT.			
		c. Adjust A5 and A7 for maximum signal amplitude on display.			
5-95		**PHASE-LOCK ADJUSTMENTS**			
		Equipment Required Oscilloscope (130C) Digital Voltmeter (3440) Counter (5245L) Frequency Comb Generator (8406A) 1000-ohm resistor 851 Display Section			
5-96a-h		a. Remove Lock Assembly A15 and connect externally to 8551 (Paragraph 5-96a through h).			
5-96i-s	16	b. Tracking Adjustments			
		(1) If required (see Paragraph 5-96m) set A14R9 2:1 ADJ ohm	200	_____	400
		(2) Set LINE . . . . . .ON FREQUENCY(GC) . . . . . .01-2 SPECTRUM WIDTH . . . .1 MC/CM STABILIZATION. . . . STABILIZED TUNE . . . . . 2 Gc and fine tuning			
5-96i,k,n		(3) Connect oscilloscope to A13V5, pin 2.			
5-96o		(4) Observe ramp as TUNE is rotated through one revolution; note step (defined in Par. 5-96o).			
Fig. 5-16		(5) Set TUNE just ccw of step and adjust A14R4 RAMP ADJ so bottom of ramp just touches 0V reference (see Figure 5-16).			
		(6) Set TUNE just cw of step and adjust A14R6 DC BAL ADJ so top of ramp just touches 0V reference.			
		(7) Set TUNE to 2 Gc; adjust oscilloscope vertical sensitivity for 10.0 cm ramp amplitude.			
		(8) Set TUNE to 4 Gc, and adjust A14R9 2:1 ADJ for 5.0 cm ramp. Retune to 2 Gc.			

Table 5-14. 8551B Check and Adjustment Test Card (Cont.)

Par. Ref.	Step	Operation		Record Min.	Act.	Max.
5-96t-v	17	c. Differential Amplifier Balance; Figure 7-26.				
		(1) Disconnect sweep at 8551 SWEEP INPUT.				
		(2) Short (grids) pins 2 and 7 of A13V5 to ground.				
		(3) Set A13R19 for +30 V above +150 V supply at A15C3, sweep input to Lock Assembly A15.	Vdc		_____	+180 V
5-96 w-ai	18	d. 10MC Oscillator and Discriminator; Figure 7-26.				
		(1) Connect counter to J26, 10 Mc output.				
		(2) Set 10MC OSC FREQ ADJ A15A1C2 for	Mc	9.998	_____	10.002
		(3) Disconnect sampler at A23P1/J29. Connect dc voltmeter at A23P1 (first discharge VM probe). Adjust 10MC AMPL OUTPUT TUNING A15A1T1 for maximum voltmeter reading. VM reading	Vdc		_____	
		(4) Adjust 10MC AMPL INPUT LEVEL A15A1C9 for point where amplifier starts to saturate.	Vdc	0.9	_____	2.5
		(5) Repeat steps (2), (3), (4); connect sampler assembly at A23P1.				
		(6) Remove short at A13V5, pin 7.				
		(7) Counter reading should be If necessary, readjust A15A1C21 for proper reading.	Mc	9.998	_____	10.002
		NOTE: If A15A1C21 is adjusted, again short grid 7 of A13V5 to ground, and recheck steps (1) through (7).				
		(8) Remove short at A13V5, pin 2.				
5-96af		(9) Connect 851 and 8551 at SWEEP INPUT and IF OUTPUT. Connect 1 Mc from frequency comb generator to 8551 INPUT, and stabilize analyzer (Fig. 3-4) on 1 Mc/cm spectrum width.				
		(10) Rotate TUNE to step, and on 851B, note linearity of comb signal on each side of step.				
		(11) Adjust DISC PRIM ADJ A15A1C16 for best compromise on both sides of step.				
		(12) Repeat steps c and d through (7) except counter reading should be	Mc	9.999	_____	10.001
5-96ai		(13) Remove short at A13V5, pin 3.				
		(14) Rotate TUNE one revolution at 2 Gc.				
		Minimum counter reading	Mc	9.974	_____	9.976
		Maximum counter reading	Mc	10.024	_____	10.026
		(15) Remove counter.				
5-96 aj-am	19	e. Search Oscillator; Figure 7-29.				
		(1) Set STABILIZATION. . . STABILIZED LINE. . . . . STANDBY PRE STAB BAL . . . . . center				

Table 5-14. 8551B Check and Adjustment Test Card (Cont.)

Par. Ref.	Step	Operation		Record Min.	Record Act.	Record Max.
5-96ak		(2) Adjust balance potentiometer A14R21 to center OSC TRACK BANALCE meter.				
		(3) Adjust search OSC GAIN potentiometer A14R22 until OSC TRACK BALANCE meter fluctuates indicating search oscillator is oscillating.				
5-96 an-as	20	f. Directional Coupler; Figure 7-29.				
		Read Note preceding Par. 5-96an before proceeding.				
		(1) Set LINE . . . . . ON STABILIZATION. .UNSTABILIZED TUNE . . . . . for coarse tuning				
		(2) Connect sweep from 851 to 8551 and oscilloscope horizontal input.				
		(3) Connect output from A15TP2 to oscilloscope vertical input; note beat-frequency amplitude, symmetry of upper and lower envelopes while tuning BWO from 2 to 4 Gc.	mV p-p	150	_____	300
		(4) If necessary, reposition coupling loop; see 5-96aq. If envelopes are nonsymmetrical, see 5-96ar, as.				
5-96 at-az	21	g. Phase-Lock Hold-In Range.				
		(1) Stabilize (Fig. 3-4) analyzer at BWO frequency of 3.6 Gc.				
5-96an		(2) Set SPECTRUM WIDTH VERNIER full ccw; slowly rotate PRE STAB BAL cw until OSC TRACK BALANCE meter jumps.				
		(3) Set LINE to STANDBY; measure and record dc voltage at A13V4, pin 2 (Fig. 7-32).	Vdc		_____	
		(4) Set LINE to ON, and rotate PRE STAB BAL to center OSC TRACK BALANCE meter; continue rotating PRE STAB BAL ccw until meter jumps again.				
		(5) Repeat step (3). Average of the absolute magnitudes of the two readings should be less than 1.05 Vdc	Vdc		_____	1.05
		(6) Stabilize analyzer at 2.0 Gc, and repeat steps (2) thru (5). Average of absolute magnitudes of the two readings should be greater than 0.35 Vdc.	Vdc	0.35	_____	
		(7) If VM readings are out of tolerance, see Paragraph 5-96az.				
5-96 ba-bg	22	h. Tracking Accuracy at Step.				
		(1) Center OSC TRACK BALANCE meter with PRE STAB BAL.				
		(2) Set SPECTRUM WIDTH VERNIER . . . CAL SPECTRUM WIDTH. . . . .100 KC/CM Frequency Comb Generator . . . .1 MC				

Table 5-14. 8551B Check and Adjustment Test Card (Cont.)

Par. Ref.	Step	Operation		Record Min.	Act.	Max
		(3) With frequency comb generator connected to INPUT, rotate TUNE to the step, and adjust STAB TUNE so marker shifts left about 100 kc as TUNE is rotated cw through step.			_____	
		(4) Tune to BWO frequency of 4.0 Gc. Note marker shift to left as TUNE is rotated cw through step; should be about 100 kc.			_____	
		(5) If necessary, adjust 2:1 ADJ A14R9 (Fig. 7-26).				
		(6) Disconnect frequency comb generator.				
5-96 bh-bn	23	i. 10- and 20-Mc Filters.				
		(1) Tune to low end of band, and observe residual signals at 20 and 30 Mc on 851 CRT.				
		(2) Compare each with signal from signal generator	dBm	-85	_____	
		(3) If residuals are within limits, phase-lock adjustments are completed; if not, see Par. 5-96bi through bn.				
5-96 bo-bu		j. Noise Check.				
		(1) Set SPECTRUM WIDTH . . . . .30 KC/CM ATTENUATOR(DB) . . . . . .0 VERT DISPLAY. . . . . LOG I.F. BANDWIDTH. . . . . 1KC SWEEP TIME. . . . 10 MILLISEC/CM I.F. GAIN (DB) . . . . . 70 FREQUENCY(GC). . . . . 2-10 TUNE . . . 2.2 Gc on Frequency Scale				
		(2) Set signal generator for 2.2 Gc; connect to INPUT. Stabilize (Fig. 3-4).				
		(3) Adjust signal generator for 7.0 cm display on 851 CRT. Observe trace for noise sidebands.				
5-96br		90 kc from F_C	dB	-54	_____	
		(4) Set FREQUENCY(GC) . . . . . .01-2 TUNE . . . . 1.1 Gc on Frequency Scale Signal Generator. . . for 1.1 Gc, 7.0 cm 851 CRT trace				
		(5) Stabilize (Fig. 3-4). Observe for noise sidebands.				
		90 kc from F_C	dB	-60	_____	
		k. Replace Lock Assembly.				

5-106. TROUBLESHOOTING.

5-107. The following types of troubleshooting information are provided in this manual.

a. Trouble Localization: a step-by-step localization procedure that assumes no knowledge of the source of the trouble; Paragraph 5-109 and Tables 5-17 through 5-20.

b. Function Troubleshooting Chart: Table 5-21; lists symptoms of nonstandard operation together with suggested checks for clearing the trouble.

c. Sectional Troubleshooting: troubleshooting information for the various sections of the 8551B (Paragraphs 5-114 through 5-169).

5-108. General troubleshooting information is contained in Tables 5-15 and 5-16. Table 5-15 contains a cross reference between assembly numbers, designations, schematic diagrams and illustrations. Table 5-16 contains general troubleshooting reference information listed alphabetically by component.

5-109. TROUBLE LOCALIZATION.

5-110. For troubleshooting purposes, the 8551B can be divided into four main sections: 1) the power supplies, 2) the receiver, 3) the phase-lock loop, and 4) the BWO and sweep circuits. A step-by-step localization chart is provided for each of these main sections. When using the charts: 1) if indication is normal, follow the heavy-line path; 2) in sub-steps, normal indication is the right-hand path; 3) after adjustment or repair, recheck following the broken-line path.

5-111. If the trouble is not found via the trouble localization procedures, verify operation with the Performance Checks (Table 5-10).

Note

Whether the trouble is located by means of the trouble localization procedures or with performance checks, always check the low-voltage power supplies (see Paragraphs 5-114, 5-116), before proceeding with any other checks.

Table 5-15. Assemblies to Schematics and Circuit Board/Assembly Illustrations

Assy No.	Designation	Schematic	Location (Fig. No.)	
			Schematic	Assy
A1	Input Attenuator Assy	RF Input	7-15	7-13
A2	Mixer/Coupler Assy		7-15	7-14
A3	Coax Mixer Assy		7-15	5-26
A4K1	Coax Switch		7-15	
A5	2GC IF Amplifier Assy		7-15	5-27
A6	Harmonic Generator Assy		7-15	6-6
A7	2GC Mixer Assy		7-15	6-7
A8K1	Coax Switch		7-15	
A9	Converter Assy	Converter	7-18	7-16, 7-17
A10	SIGNAL IDENTIFIER Switch Assy	Converter	7-18	7-10
		Switching Logic	7-21	
A11	FREQUENCY(GC) Switch Assy	RF Input	7-15	7-11
		Switching Logic	7-21	
		Converter	7-18	
A12	SPECTRUM WIDTH Switch Assy	Switching Logic	7-21	7-12
		Helix Control Input	7-32	
A13	Helix Control Assy	10MC Osc/Disc.	7-26	7-30
		Helix Control Input	7-32	7-31
		Helix Control	7-35	
A14	Search Drive Assy	10MC Osc/Disc.	7-26	7-27
		Sampler/Search Drive	7-29	
A15	Lock Assy	10MC Osc/Disc.	7-26	7-23
		Sampler/Search Drive	7-29	7-25
A16	HV Time Delay Assy	Helix Control	7-35	7-33
		Primary Power	7-38	
A17	Helix Voltage Shaper Assy	Helix Control	7-35	7-34
A18	LV Rectifier Assy	Primary Power	7-38	7-37
		Low-Voltage Power Supply	7-41	
A19	LV Power Supply Assy	Low-Voltage Power Supply	7-41	7-39, 7-40
A20	LV Series Regulator Assy	Low-Voltage Power Supply	7-41	7-42, 7-43
A21	Meter Board Assy	Helix Control Input	7-32	7-8
A22K1	Coax Switch	RF Input	7-15	7-13
A23	Sampler Assy	Sampler/Search Drive	7-29	5-17
A24	STABILIZATION Switch Assy	Switching Logic	7-21	7-28
		Helix Control Input		
A25	Bias Generator Assy	RF Input	7-15	7-44

Table 5-16. General Troubleshooting Reference Information

Subject	Paragraph	Table/Figure
BWO		
Aging, symptoms of	5-121	
Connections		Figure 5-19
Localizing trouble in	5-124	
Noise and sideband check	5-127	
Power supply troubleshooting	5-131	
Troubleshooting the BWO	5-120	
Charts		
BWO Power Supplies, localization		5-27
BWO sweep circuits, localization		5-19
Harmonic Generator A6/2GC Mixer A7, localization		5-30
Initial localization		5-17
LV Power Supplies, troubleshooting		5-24
Overall troubleshooting		5-21
Phase-Lock Loop, localization		5-20
Receiver, localization		5-18
10MC VTO/Discriminator, localization		5-31
Circuit board extenders, use of	5-172	
Converter Assy A9, troubleshooting	5-140	
FREQUENCY(GC) Switch, 1/n attenuator check		5-29
Frequency identifier circuits, trouble in		5-21:7
Frequency response deterioration		5-21:5
Frequency unstable		5-21:4
Harmonic Generator Assy A6, troubleshooting	5-144	
Helix Control, troubleshooting	5-134	
Helix Control Input, troubleshooting	5-138	
Lock Assy A15, working on	5-150	
LV Power Supplies, troubleshooting	5-116	5-23, 5-24
Ohmmeters, safe ranges for transistor checks		5-33
Parts location	5-170	7-2
Phase-Lock Assy, excessive residuals in	5-160	

Table 5-16. General Troubleshooting Reference Information (Cont.)

Subject	Paragraph	Table/Figure
Phase-Lock Loop, troubleshooting	5-148	
Pulse Amplifier A15A4, troubleshooting	5-158	
Q1-Q6, in-circuit testing	5-114	5-22
Relays		
K1, Time Delay	5-169	
K3, Filament Over Voltage	5-168	
K4, Helix Overload	5-164	
Sampler Assy A23, troubleshooting	5-156	
Sensitivity decrease		5-21:3
Spectrum width error		5-21:1
SPECTRUM WIDTH Switch, check data for		5-28
Switching Logic, troubleshooting	5-138	
Transistors		
Amplifier characteristics		Figure 5-24
Biasing		Figure 5-24
Emitter-base bias, check of	5-178a	
General information	5-174	
Q1-Q6, in-circuit testing of	5-114	5-22
Resistance measurement data, typical		5-32
Resistance measurements, safe ohmmeter ranges for		5-33
Short or open, check for	5-178b, 5-179	
TUNE Control brake check	5-238b, c	
Tuning accuracy, loss of		5-21:2
2GC IF Amplifier Assy A5, troubleshooting	5-146	
2GC Mixer Assy A7, troubleshooting	5-144	
7-CPS Oscillator/Differential Amplifier, troubleshooting	5-161	

Table 5-17. Trouble Localization Chart, Initial

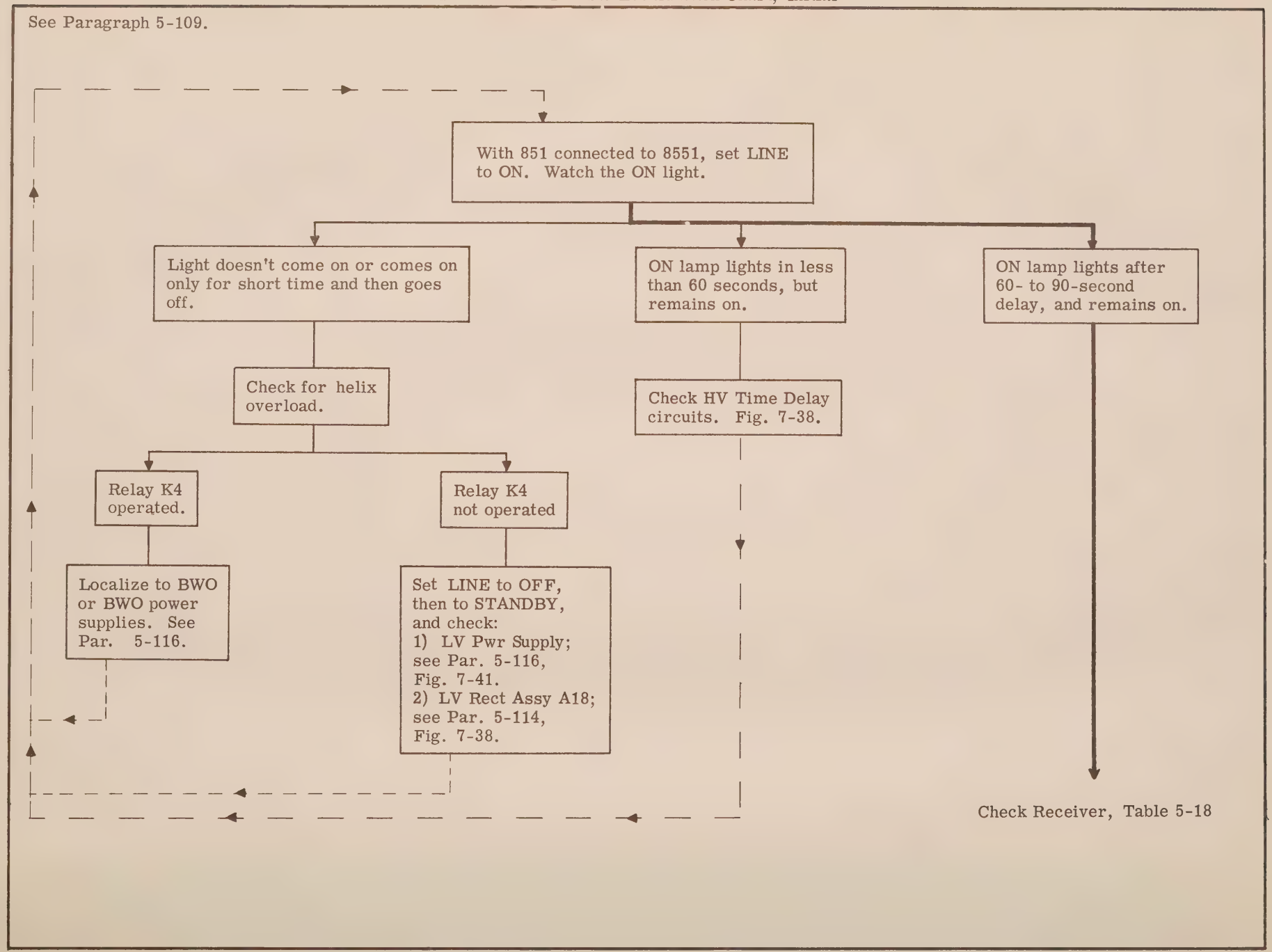


Table 5-18. Trouble Localization Chart, Receiver (Sheet 1 of 3)

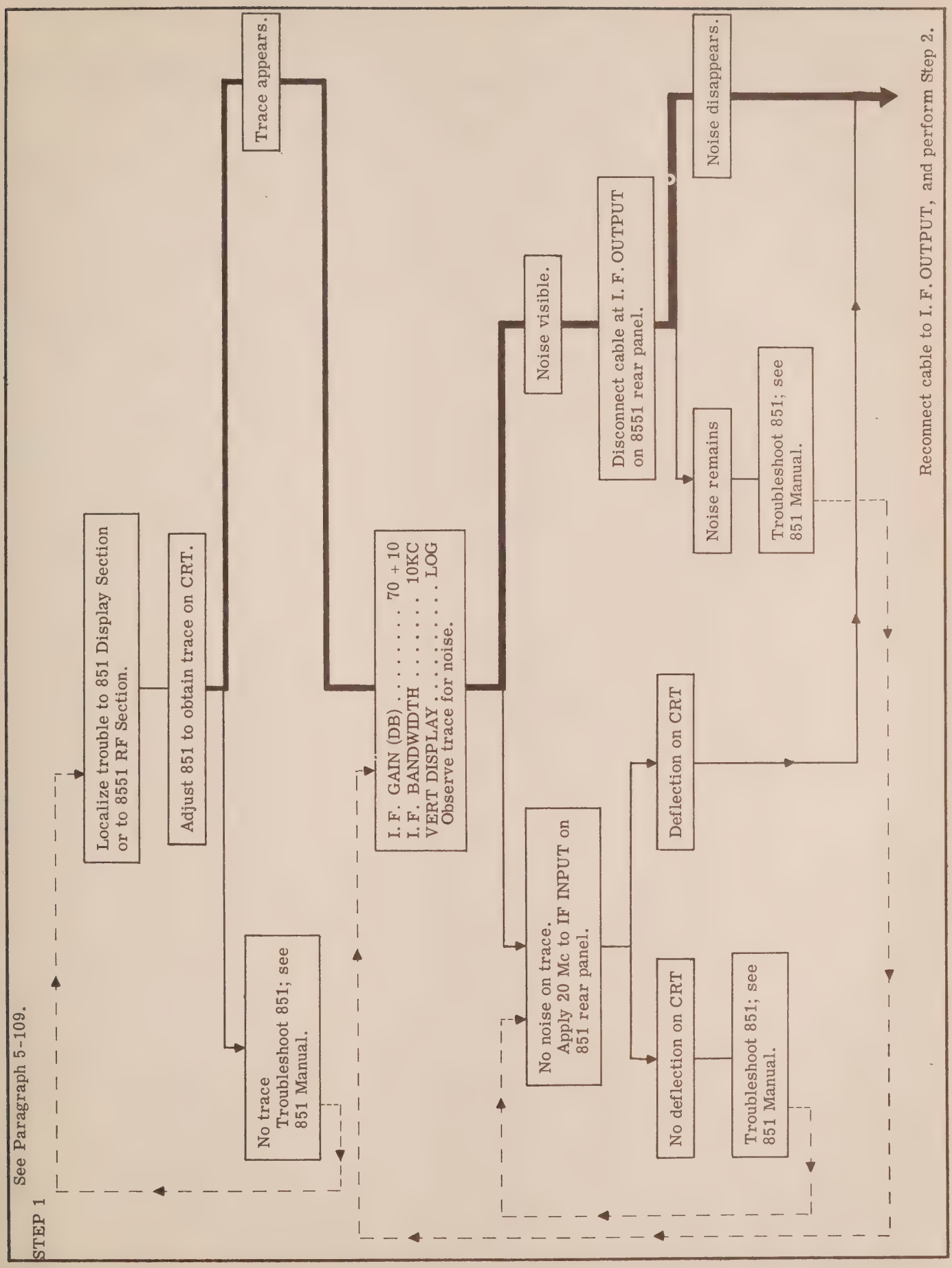
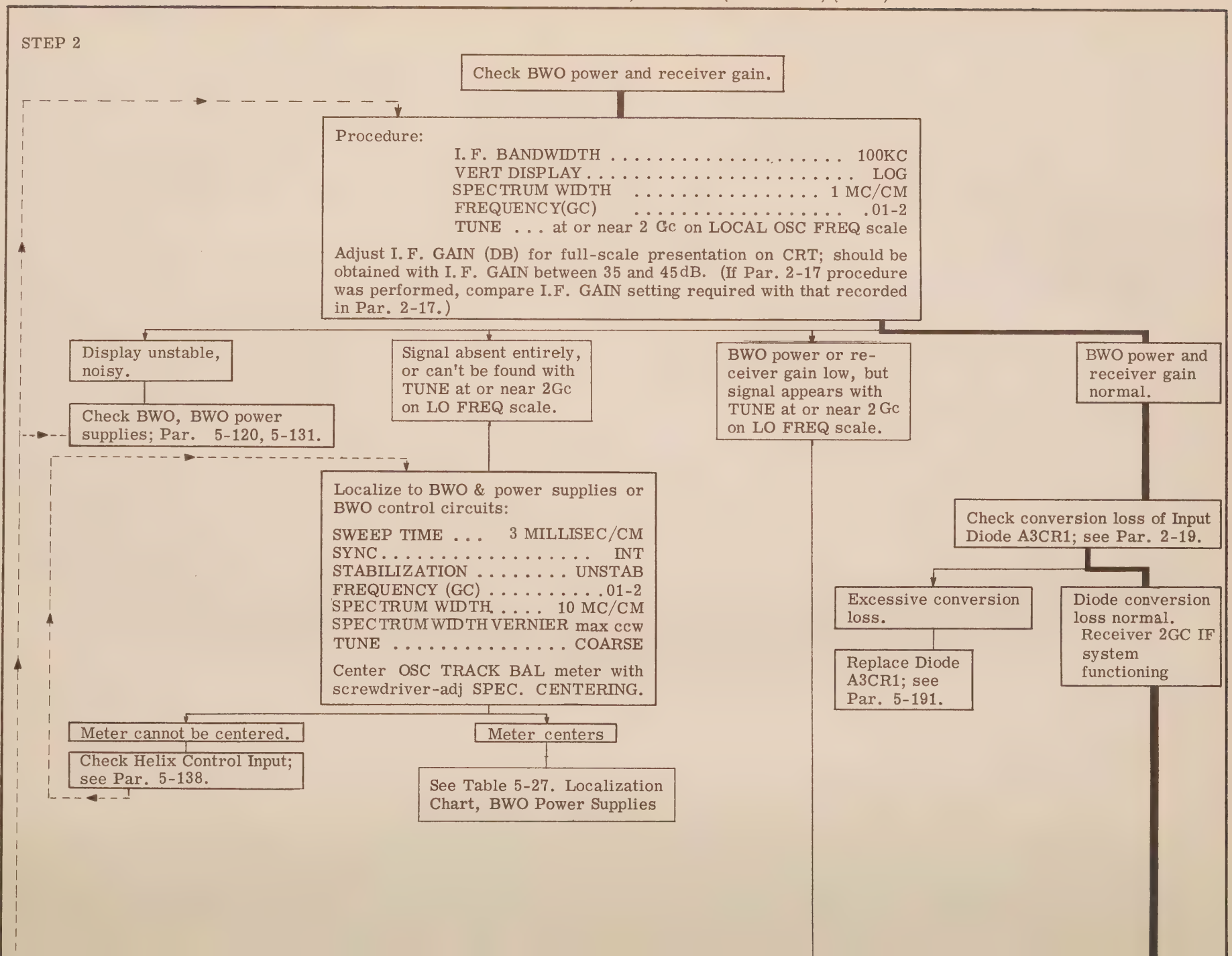


Table 5-18. Trouble Localization Chart, Receiver (Sheet 2 of 3) (Cont.)



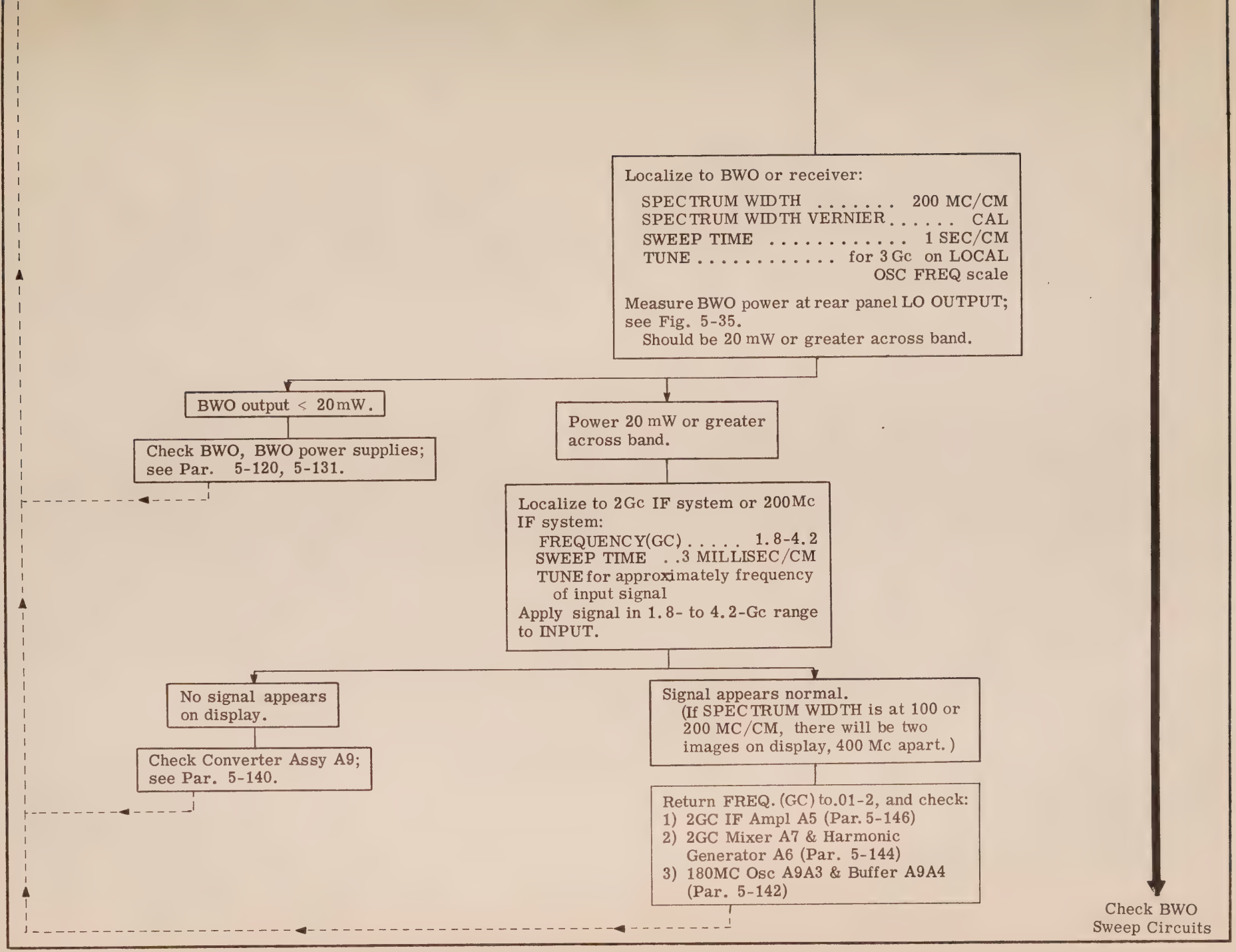


Table 5-18. Trouble Localization Chart, Receiver (Sheet 3 of 3) (Cont.)

Table 5-19. Trouble Localization Chart, BWO Sweep Circuits

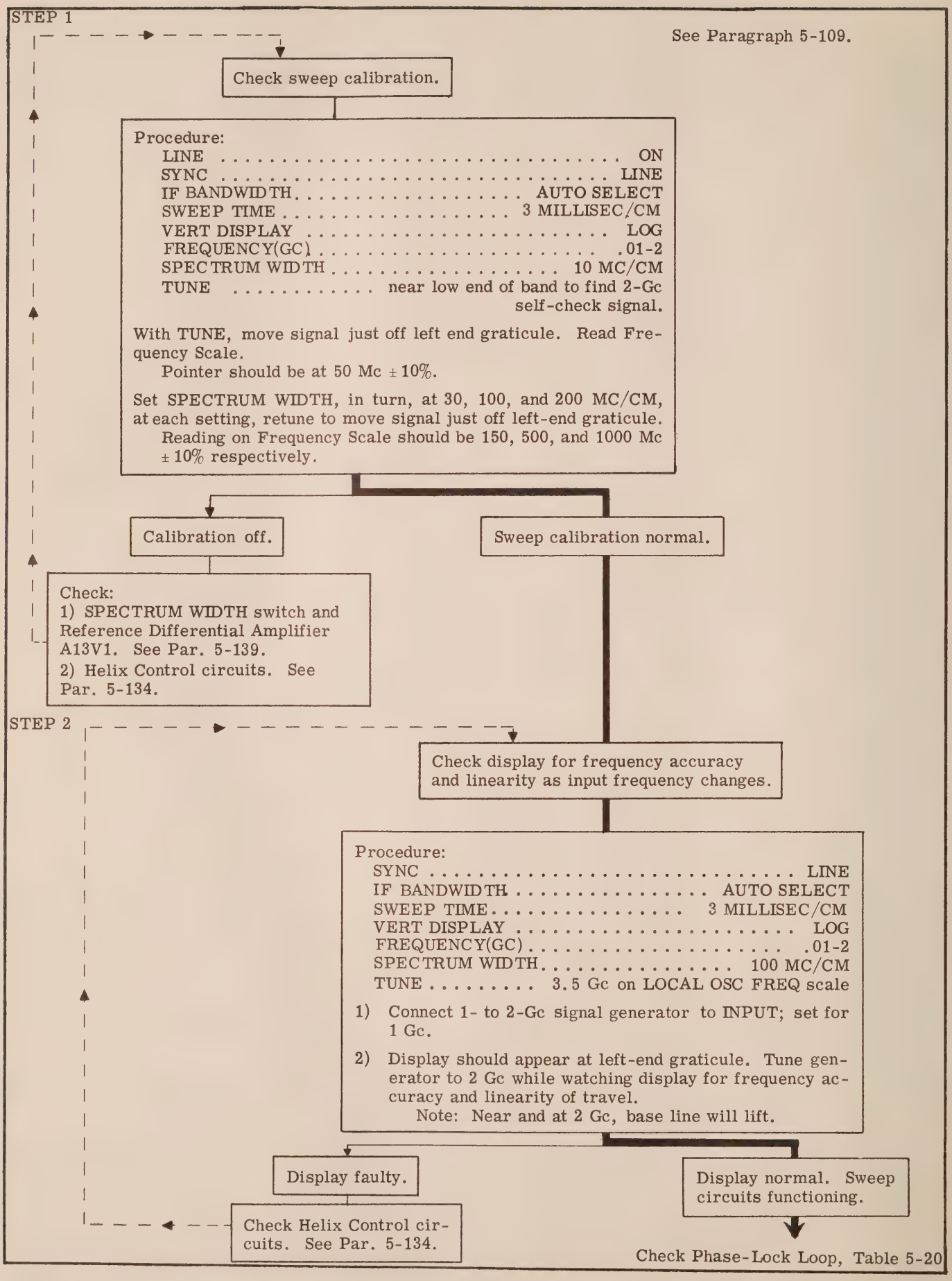


Table 5-20. Trouble Localization Chart, Phase-Lock Loop

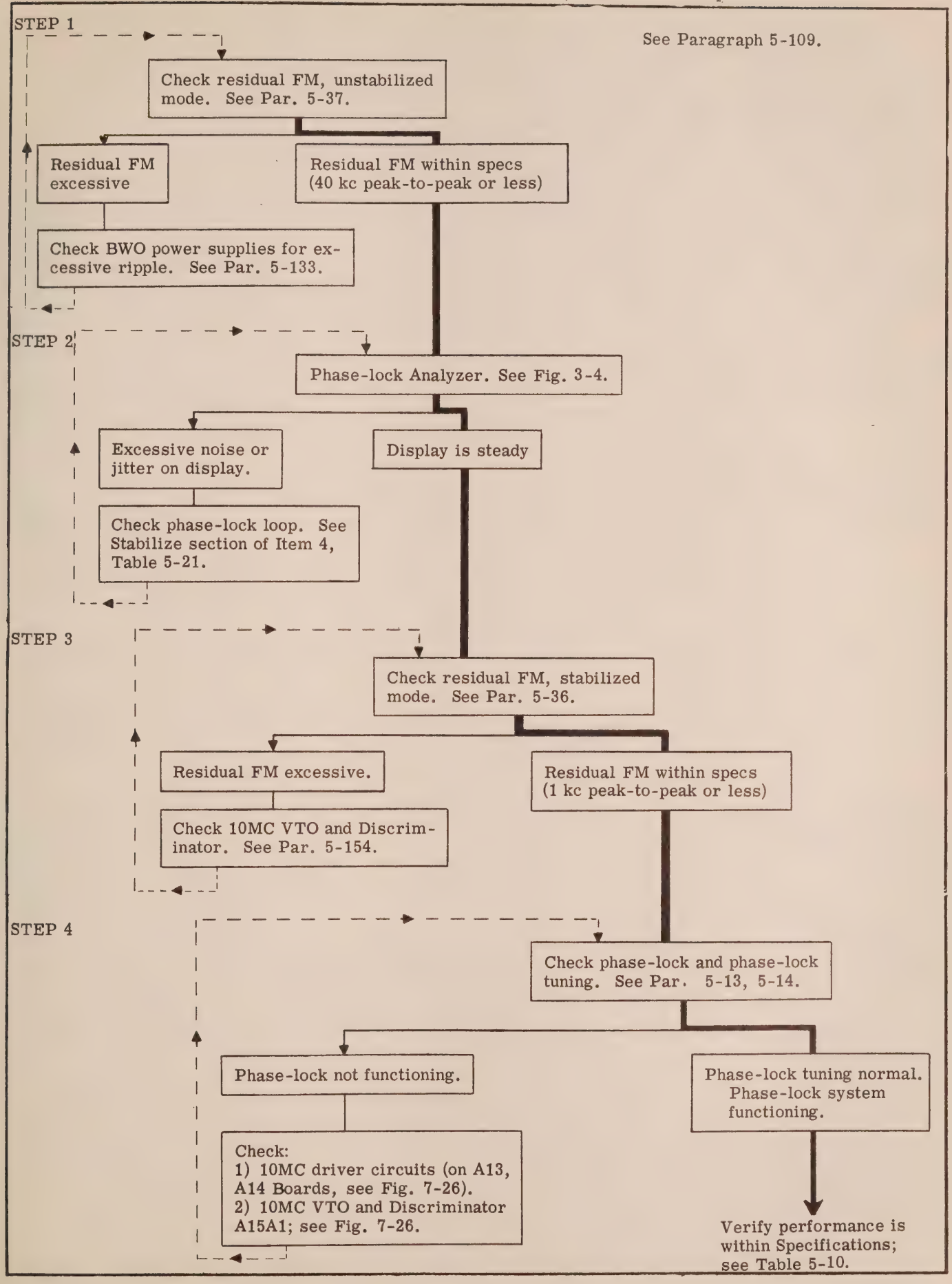


Table 5-21. Functional Troubleshooting Chart

Symptom	Operating Mode	Background Information	Possible Cause	Suggested Remedy
1. SPECTRUM WIDTH AND SWEPT-FREQUENCY LINEARITY				
Percent error is same, range to range	Unstabilized	Fig. 4-4 Par. 4-17		Perform procedure given in Par. 5-59 thru 5-62.
Percent error is not same, range to range		Fig. 4-4		Check A13V1, A13V2, A13V3, A13V4. See Par. 5-138.
Percent error greater than ±5% of indicated frequency	Stabilized	Par. 4-11		Check adjustments, Par. 5-59.
2. TUNING ACCURACY				
Loss of tuning accuracy		Fig. 4-5		Check R4 SPECTRUM CENTERING Adjustment, Par. 3-31
				Check BWO frequency calibration Par. 5-58.
			SIGNAL IDENTIFIER not set at OFF	Set SIG IDENT to OFF.
			180MC Osc (3rd LO) and thus the 1800MC Osc (2nd LO) are detuned	Align 180MC Osc (see Par. 5-82).
LO dial is correct but "n" Frequency Scales on rotating drum are offset.				Look for mechanical misalignment of Scales or for bent pointer; Par. 5-234.
3. SENSITIVITY				
Decrease in Analyzer sensitivity; 2 GC IF		Fig. 4-2, 4-3	A3CR1 Mixer diode defective	To check diode, measure conversion loss: see Par. 2-19. Diode replacement procedure, see Par. 5-191.
			A3R1 defective	See Par. 5-194.
			2GC IF Assy A5	Check 2GC IF Ampl gain, Par. 5-146.
			A25 Mixer bias or A3CR1 Diode current incorrect	See instructions, Par. 5-101, 5-102.

Table 5-21. Functional Troubleshooting Chart (Cont.)

Symptom	Operating Mode	Background Information	Possible Cause	Suggested Remedy
			A7 2GC Mixer/A6 Harmonic Generator	Measure Diode A7CR1 current, see Par. 5-144.
Decrease in analyzer sensitivity, 200MC IF (FREQUENCY (GC) at 1.8-4.2)			A2 Mixer/Coupler Assembly	See Par. 5-213.
Loss of sensitivity noted when operating with FREQUENCY (GC) set for any coaxial band			BWO power output low	Measure BWO output power. If low, check BWO; see Par. 5-120.
			Loss of sensitivity in 200MC IF Amplifier A9A1	
			Loss of sensitivity in 200-20MC Mixer Assembly A9A2	
			Loss of sensitivity in 20MC IF Amplifier in 851	
			Loss of BWO power due to insufficient coupling	See Par. 5-100.
4. FREQUENCY STABILITY				
Frequency unstable		Fig. 4-6, 4-10	Power Supplies	See Par. 5-116.
	Unstabilized		Ripple, BWO helix. To check: Par. 5-131	Check A13V1-4, A13V6-9.
				Series Regs V1, V2
			Ripple, BWO anode. Check: Par. 5-131	+300V supply, Anode supply V6
			Ripple BWO collector. Check: Par. 5-131	Check V4
			BWO (Noise FM) Check: Par. 5-127	Replace BWO, Par. 5-187.
OSC TRACK BALANCE meter drifts and/or is jumpy (jumpiness referred to is exclusive of 7-cps oscillation; this is normal)		Fig. 4-8	Search Differential Amplifier	Check A14Q2, A14Q3
			Misadjustment of A15A1C9	See Par. 5-96z, ar
			Noisy Pulse Amplifier emitter followers	Check A15A4Q5-7
			Noisy Sampling Diode A23CR2	See Par. 5-217.
Noise FM	Stabilized		10MC Oscillator	Check A15A1V1, A15A1V2, A13V5, A13V5, A15A1CR1; check phase-lock alignment (Par. 5-95)
7-cps FM			Phase-lock loop open, BWO being FM'd by Search Osc	Check R6 for broken leads; see Par. 5-205
				Check Sampler diodes A23CR1-2, Par. 5-214.

Table 5-21. Functional Troubleshooting Chart (Cont.)

Symptom	Operating Mode	Background Information	Possible Cause	Suggested Remedy
				Verify 10MC VTO functioning properly; see Par. 5-96v-ai.
				Check Pulse Amplifier A15A4 Par. 5-158
5. FREQUENCY RESPONSE				
Frequency response not within specs, 2GC IF only			High SWR, A3 Coax Mixer Assy	Check A3CR1, A3R1 and A3E1 (see Fig. 6-3).
Frequency response not within specs, 200MC IF only (FREQUENCY(GC) at 1.8-4.2)			High SWR, A2 Mixer/Coupler Assy	Check A2CR1; see Par. 5-213.
Frequency response not within specs with FREQUENCY(GC) set for any coaxial band			High SWR, ATTENUATOR(DB)	At one setting only resistive card probably defective; see Par. 5-200.
				At all settings, check: 1)pin assembly on INPUT Connector J1 2)Connector J36 on Coax Switch A22 and connector on ATTENUATOR(DB) cable W34.
6. NOISE SIDEBANDS				
Noise and spurious sidebands appear in display			Noisy tubes	Check Helix Control Assy A13 tubes
				A15A1V1 in Lock Assy A15
				BWO (see Par. 5-127)
7. SIGNAL IDENTIFIER				
Signal shift is either more or less than 2 cm	SIGNAL IDENTIFICATION switch operated			Perform SIGNAL IDENTIFICATION Check and Adjustment; see Par. 3-38.
				Check SIGNAL IDENTIFICATION switch, including voltage-divider stick (shown in Fig. 7-18).
8. STABILIZATION				
Lose phase-lock as TUNE is turned	Stabilized		Sampler coupling too loose	Par. 5-96at-az
			BWO power low; measure (Par. 5-44)	Check BWO; Par. 5-120.

5-112. SECTIONAL TROUBLESHOOTING.

5-113. Information on troubleshooting the various sections of the 8551 is given in Paragraphs 5-114 through 5-169.

5-114. Checking Transistors Q1-Q6, LV Rectifier A18.

Note

For general data on in-circuit and out-of-circuit testing of transistors, see Paragraph 5-174.

5-115. To check base-emitter junction of transistor Q1, Q2, Q3, Q4, Q5, or Q6 (associated with LV Rectifier Assembly A18), connect voltmeter as noted in Table 5-22. In each transistor, the base should be approximately 0.3 negative with respect to the emitter; for actual voltages, see schematic, Figure 7-38. Any sensitive high-impedance voltmeter, such as the HP 3440 Digital Voltmeter or 412A Precision V-O-A, is suitable.

5-116. Troubleshooting LV Power Supply.

5-117. The low-voltage power supply is completely transistorized. There are three regulated supplies, 1 -200-V supply and 2 +150-V supplies. The 2 +150-V supplies are stacked so that +150 V and +300 V are available.

5-118. OVER-CURRENT PROTECTION. Over-current protection is provided by two relays, A19K1 and A19K2, which are in series with the supplies. If a short-circuit should occur in the -200-V supply, relay

Table 5-22. Connection Point, Q1-Q6 Base-Emitter Forward Bias Check

Xstr	Measurement	Connect VM Between Chassis and	
		Component	Point on Fig. 7-37
Q1	Base to chassis	Q2 base	Q2B
	Emitter to chassis	Q1 emitter	A18A-4 (A18R3)
Q2	Base to chassis	Q2 base	Q2B
	Emitter to chassis	Q2 emitter	A18A-6 (A18R4)
Q3	Base to chassis	Q2/Q3 base	Q2B or Q3B
	Emitter to chassis	Q3 emitter	A18A-5 (A18R5)
Q4	Base to chassis		A18A-8 (A18R7)
	Emitter to chassis	Q2/Q3 base	Q2B or Q3B
Q5	Base to chassis		Tie Point MP8-2
	Emitter to chassis	Q5 emitter	MP8-4
Q6	Base to chassis	Q6	MP8-1
	Emitter to chassis		MP8-2

Table 5-23. Resistances to Ground, 8551 Power Supplies

Supply	Measurement Point, HV TD Assy A16	Figure Reference	Typical Resistance (ohms)	
			*410B	**410C
-200V	-200	7-33	7K	5K
-15V	-15	7-33	4K***	70***
+15V	+15	7-33	4K***	330***
+150V	+150	7-33	3.5K	3K
+300V	+300	7-33	8K	10K
BWO Anode	ANODE	7-33	90K	110K
BWO Helix	DELAY LINE	7-33	800K	900K
BWO Collector	A16R3 (A)	7-33	800K	900K

*As measured with 410B VTVM, 851 not connected to 8551.

**As measured with 410C Electronic Voltmeter, 851 connected to 8551.

***On RX1K range.

A19K2 energizes, disconnecting the regulators from the rectifier, and also disconnecting its own operating circuit so that it de-energizes. As long as there is a short-circuit, A19K2 will continue to energize and de-energize. This causes an audible buzz, which is in effect a short-circuit alarm. Relay A19K1 operates in the same manner if a short-circuit occurs in either the +150-V or +300-V supply. Table 5-23 gives typical resistances to ground for each of the supplies.

5-119. TROUBLESHOOTING. Normal voltages are indicated on the LV power supply schematic, Figure 7-41. If the LV power supply stops regulating some of these voltages will change. However, by measuring potential differences across the semiconductors and referring to the schematic, voltages shown on the schematic will still help in isolating trouble to a particular component. Table 5-24 gives possible troubles for high- or low-voltage indications in each supply. If any voltage is low, check output of rectifiers before trouble-shooting regulator. See Table 5-11 for ripple values. Also refer to Figure 4-10.

Table 5-24. Troubleshooting Chart, LV Power Supplies

Supply	Trouble Indication	Possible Cause
+ 300V	Voltage high	shorted A20Q1, Q2 shorted A19A1 open A19Q2 shorted A19Q3 open A19CR1 high + 150V
	Voltage low	open A20Q1, Q2 open A19Q1 shorted A19Q2 open A19Q3 shorted A19CR1 low + 150V
+ 150V	Voltage high	shorted A20Q3, Q4 shorted A19Q4 open A19Q5 shorted A19Q6 open A19CR7 high -200V (more negative)
	Voltage low	open A20Q3, Q4 open A19Q4 shorted A19Q5 open A19Q6 shorted A19CR7 low -200V (more positive)
-200V	Voltage high	shorted A20Q5, Q6 shorted A19Q7 open A19Q8 shorted A19Q9 open A19CR13
	Voltage low	open A20Q5, Q6 open A19Q7 shorted A19Q8 open A19Q9 shorted A19CR13

5-120. Troubleshooting the BWO.

5-121. SYMPTOMS OF AGING.

5-122. Common symptoms of BWO aging are:

a. Reduced RF output throughout tuning range.

b. Complete loss of RF output at some one frequency.

c. Persistent shutdown (Helix Overload Relay K4 operates) when BWO is being operated toward high end of tuning range.

The first two symptoms usually are caused by reduced cathode current, while the third usually is caused by gas ionization in the BWO. If the cause of the last symptom is gas ionization, no adjustment of operating voltages will restore normal full-band operation.

5-123. To determine if the cause of the symptom is actually the BWO:

a. Measure BWO filament voltage and current (see Paragraph 5-126, a-h).

b. If heater voltage and current are correct, check anode voltage supply (see Paragraph 5-126, steps a, c-e).

c. If voltage to BWO anode is correct, and tube is within warranty, go through the procedure given in Paragraph 5-124 to localize the trouble. If tube is outside of warranty, try the procedure given in Paragraph 5-183 before replacing the tube.

5-124. LOCALIZATION.

5-125. EQUIPMENT REQUIRED.

a. DC Voltmeter (3440A): item 2 in Table 5-1.

b. Clip-On DC Milliammeter (428B): item 4 in Table 5-1.

c. Resistors:
120K 10% 2W
50K 10% 2W
50K 10% 1W
5 ohm 10% 10W

d. Clip leads, 3 each, 10-inch or longer.

e. Screwdriver with long insulated handle.

WARNING

Throughout procedure, remember dangerously high voltages are present on BWO leads.

5-126. PROCEDURE. The following procedure isolates trouble to the BWO tube or to the power supplies.

a. Disconnect 8551 from power source.

b. Rest 8551 on instrument top, remove bottom cover and right side panel. The BWO is located immediately below the Helix Voltage Shaper Assembly A17 on the bottom of the instrument. The BWO terminals are on the end near the rear panel. Remove the 6 screws securing Helix Voltage Shaper Assembly A17 to right side frame and rear chassis. Position assembly A17 out of the way.

c. Disconnect helix, collector, anode, and filament (brown) leads. See Figure 5-19 for BWO terminal arrangement and color code. Connect each lead through the loading resistor specified in Table 5-25 to chassis ground.

d. Set

TUNE . . . to 2 Gc on LOCAL OSC FREQ scale

SPECTRUM WIDTH VERNIER . . . . max ccw

e. Connect 8551 to power source, and set LINE to ON. Refer to Table 5-25, and measure voltages as indicated. If voltages are correct, proceed to next step; if incorrect, check power supplies.

Table 5-25. Resistor Substitution Data, Stewart BWO, 8551B

Lead	Loading Resistor[1]	Approx Voltage across Resistor[2]
Yellow (helix)	120K 10% 2W	320 to 360 Vdc
White (collector)	50K 10% 2W	420 to 500 Vdc
Blue (anode)	50K 10% 1W	for voltage specified on tube
Brown (filament)	5 ohm 10% 1W	-6.3 Vdc

[1]Connect Loading Resistor between lead and chassis.
[2]Measure with TUNE at 2 GC and SPECTRUM WITH VERNIER set max ccw.

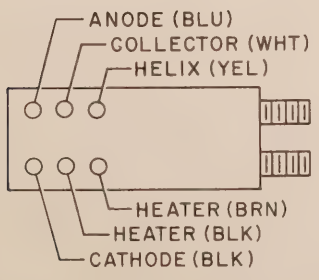


Figure 5-19. BWO Connections

f. Disconnect 8551 from power source. Disconnect loading resistors. The next check will be of current; to provide adequate loops for safe measurement of the currents, reconnect leads to BWO as follows:

(1) Connect collector and anode leads directly to BWO.

(2) Connect helix and filament leads to BWO via clip leads at least 10 inches long to provide a sufficiently large loop so that current can be measured with safety. Dangerously high voltages are present in and around the BWO when the instrument is turned on, and great care should be used when making measurements near the BWO.

(3) Disconnect cathode lead from BWO, and reconnect lead to BWO cathode terminal via a 10-inch or longer clip lead.

g. Reconnect 8551 to power source, and set LINE to ON.

h. Using Clip-On DC Milliammeter (428B):

(1) Monitor filament current (should be approximately 1 ampere). If there is no filament current, the filament is probably open. Disconnect 8551 from power source and check with an ohmmeter (such as the 410B/C or 412A); connect ohmmeter from heater (brn) to heater (blk) (see Figure 5-19). Filament resistance should be approximately 1 ohm.

(2) Monitor helix current as TUNE is turned through its range from 2 to 4 Gc. (Should be approximately 1-1/2 to 4 mA maximum across the band, with current at high end of band typically near maximum.

Note

If total current exceeds approximately 6.2 mA, Helix Overload Relay K4 turns off the high voltage.

(3) Monitor helix current at high end of band. Assuming helix overload relay did not operate with TUNE at 4 Gc, set TUNE at 4 Gc and monitor helix current for 5 to 10 minutes to be sure that helix current does not increase with time.

Note

If helix overload relay operates with TUNE at 4 Gc, trouble could either be tube aging or defocused BWO.

(4) Monitor cathode current. (Correct cathode current is stamped on tube; typically it will be from 9 to 12 mA.

Note

Low cathode current generally indicates aging of tube though it may indicate a bad anode.

i. Set TUNE to 4 Gc on LOCAL OSC FREQ scale. At ANODE test point on the A16 HV Time Delay Assembly board (see Figure 7-33), measure anode voltage. (Voltage which should be obtained is stamped on side of BWO tube.)

Note

If anode voltage is low, and voltage measured in step e was correct, anode may be shorted or partly shorted.

5-127. BWO NOISE AND SIDEBAND CHECK.

5-128. Two simple checks for localizing noise to the BWO are given below. Both should be performed, and if both indicate the BWO is the source of the noise appearing in the display, the BWO requires replacement (see Paragraph 5-187).

5-129. VARYING THE ANODE VOLTAGE. Anode voltage is adjusted with BWO ANODE ADJ A16R8 on the A16 HV Time Delay Assembly board (Figure 7-33). The adjustment is accessible with the 8551 bottom cover removed. While decreasing anode voltage slightly, watch the display on which the noise is present; if noise disappears, noise probably is in the BWO.

5-130. SCREWDRIVER TEST. This check must be made with the Analyzer unstabilized. If noise and/or sidebands appear when operating stabilized, set STABILIZATION to UNSTABILIZED. Leave the 8551 connected to the 851, rest the 8551 on its left side, and remove the bottom cover. Then, using a metal screwdriver with a long insulated handle, run the screwdriver along the length of the edge of the BWO. In this check the screwdriver is used to distort the magnetic field of the BWO and slightly change its focus; if the noise or sidebands either disappear or increase, the BWO is the noise source.

WARNING

Be extremely careful when working near or with the BWO when power is turned on. Dangerously high voltages are present.

5-131. Troubleshooting the BWO Power Supplies.

5-132. Because the high voltages supplies to the BWO are controlled by the helix control circuit it may be difficult to determine whether one of the supplies or the control circuit is at fault; localization procedures are given in Table 5-27.

5-133. If tuning is normal but there is excessive residual FM in the BWO output:

a. Check the low-voltage power supplies for excessive ripple (see Paragraph 5-55 and Table 5-11).

b. Check the BWO supplies for ripple; setup is shown in Figure 5-20, and limits and test points are given in Table 5-26. When checking, set TUNE for 2 Gc on LOCAL OSC FREQ scale.

Table 5-26. BWO Ripple Voltage Limits

Measurement	Where	Ripple Test Limits (mV rms)
BWO Anode	ANODE on A16 Bd	< 3.6
BWO Helix	DELAY LINE on A16 Bd	< 1.8
BWO Collector	At BWO; lead coded white	≈ 250. (VM reading of 25 with 10:1 Probe)

WARNING

If there is trouble in the BWO power supplies, dangerously high voltages can be present even if TUNE is set to 2 Gc. Therefore always use every precaution when working on or near the BWO. With TUNE at the high end, dangerously high voltages are always present.

5-134. Troubleshooting the Helix Control Circuit.

5-135. Trouble in the helix control circuit normally falls into one of two categories: 1) nonlinearity caused by problems in Helix Voltage Shaper Assembly A17 (usually one of the diodes), or 2) total loss of sweep caused by failure of some component. Since the helix control circuit is a feedback circuit, normal changes in the gain of individual tubes generally will not affect overall operation of the circuit.

5-136. NONLINEARITY. Nonlinearity of the display in general will be caused by an open or a short in one of the diodes in Helix Voltage Shaper Assembly A17. Linearity can be checked as follows:

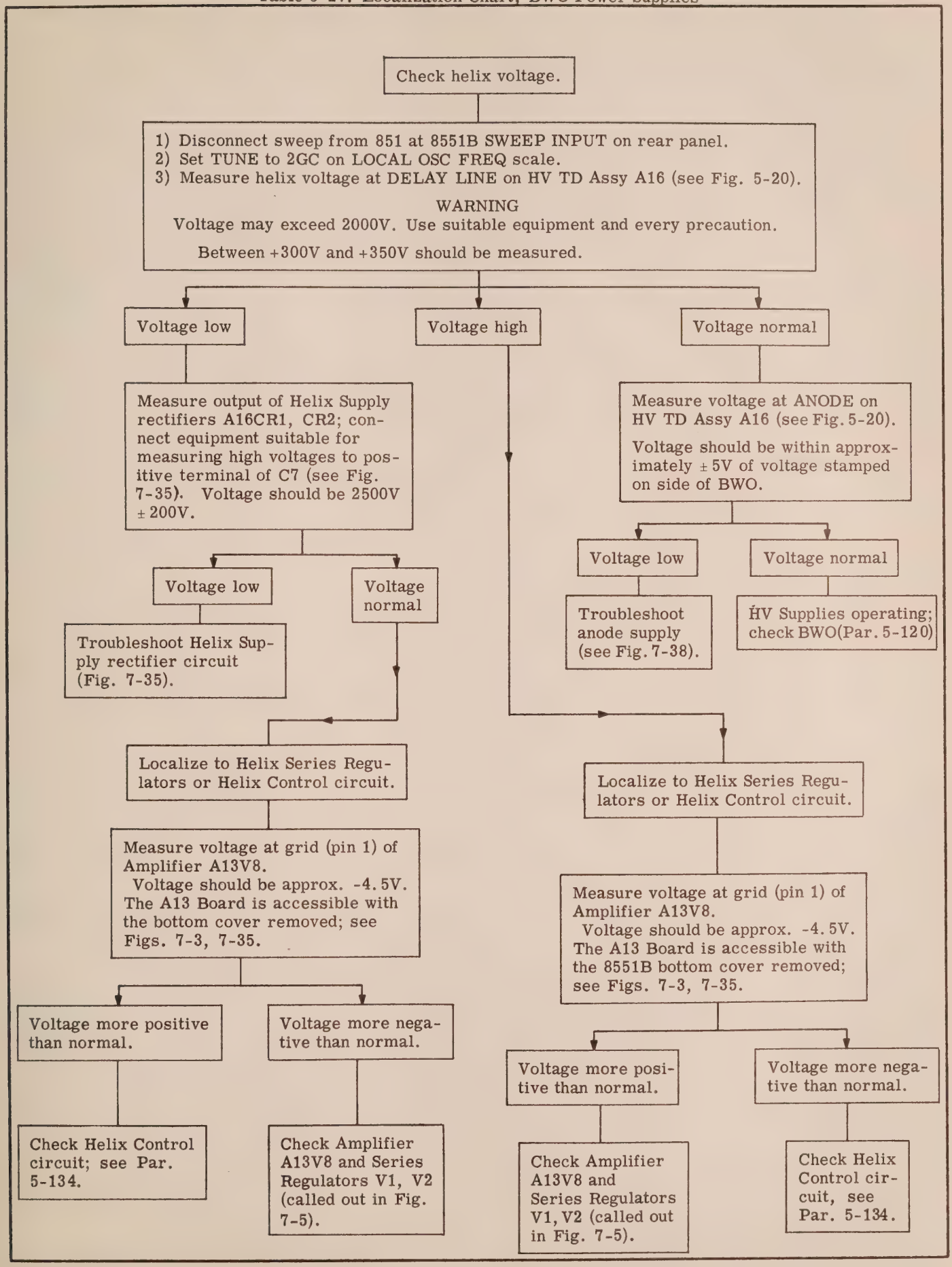
a. Set

FREQUENCY(GC). 01-2
SPECTRUM WIDTH. . . . . 200 MC/CM
SPECTRUM WIDTH VERNIER . . . . . .CAL
SIGNAL IDENTIFIER . . . . . .OFF
TUNE . . . . . for 1 Gc on Frequency Scale

b. Connect Frequency Comb Generator 8406A to 8551B INPUT, and set for 100-Mc comb markers.

c. Observe display. Comb markers should be equally spaced across the 851 CRT. A shorted diode in the helix voltage shaper assembly causes the markers at the left edge of the CRT to crowd in toward the center. The degree of crowding depends upon which diode is shorted. A shorted A17CR9 causes least crowding, while a shorted A17CR1 causes most.

Table 5-27. Localization Chart, BWO Power Supplies



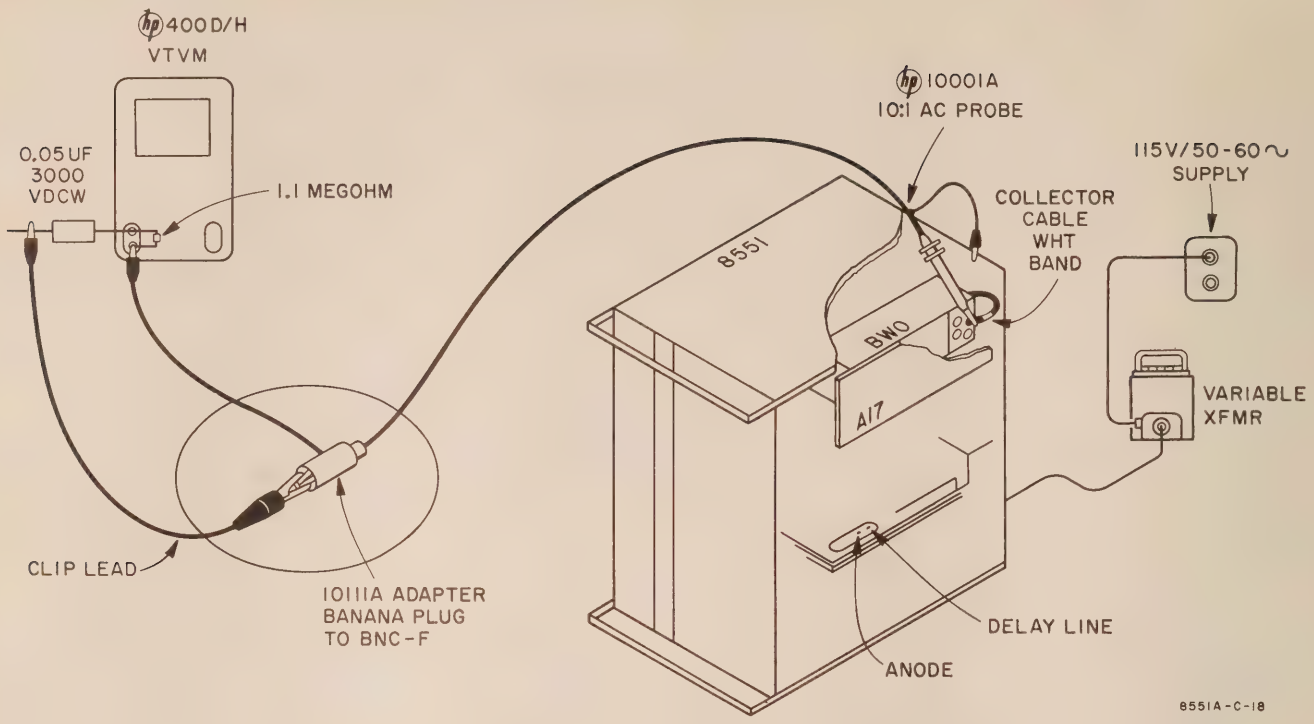


Figure 5-20. Setup, 8551 BWO Ripple Voltage Measurement

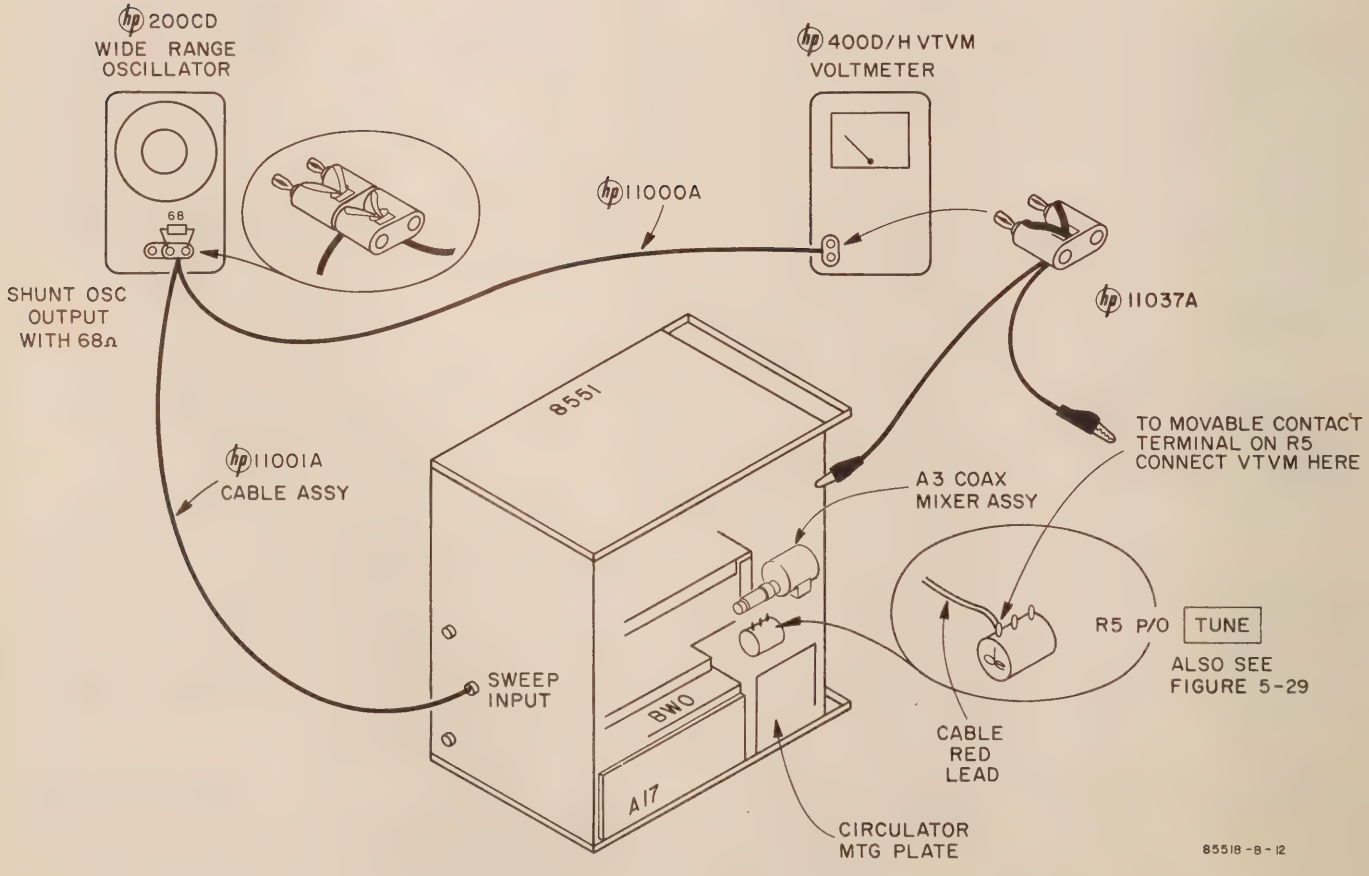


Figure 5-21. Setup, SPECTRUM WIDTH and A13V1 Reference Differential Amplifier Check

d. An open diode causes the right-hand markers to shift off the right edge of the CRT (i.e., the BWO never reaches 4 Gc). An open A16CR1 has the least effect on the display, and an open A17CR9 has the most.

5-137. NO SWEEP. The helix control circuit is a feedback circuit, and therefore a failure such as an open or shorted component will upset all voltages around the loop. Thus, a careful check of dc voltages around the loop should locate the faulty component. For example, if A13R38 should open (the BWO cannot be tuned, but you know that the high-voltage power supplies are operating because voltages are very high), a check of voltages around the loop reveals the following:

a. The voltage at test point 8 is much more negative than normal. This in itself does not pinpoint the fault, but certainly this abnormal voltage is causing the high voltage power supplies to be excessively high.

b. Voltage at test point 9 is excessively high (probably checked during the testing of the high-voltage power supplies). This excessively high voltage is to be expected considering the voltage at test point 8.

c. Voltage at test point 10 is higher than normal. This is to be expected considering the voltage at test point 9.

d. Voltage at test point 11 is higher than normal. This is to be expected considering the voltage at test point 10.

e. Voltage at test point 7 is higher than normal. This is to be expected considering the voltage at test point 11. But voltage at test point 8 was much more negative than normal. This is NOT normal considering the voltage at test point 7. Therefore the trouble lies somewhere between test point 7 and test point 8. Thus A13R38 has been pinpointed. A similar technique will locate most other faults.

5-138. Troubleshooting the Switching Logic and Helix Control Input Circuit.

5-139. The switching logic and helix control input circuit can be checked as indicated in Figure 5-21. Proceed as follows:

a. Set
SIGNAL IDENTIFIER. . . . . OFF
SPECTRUM WIDTH VERNIER. . . . . CAL
FREQUENCY(GC) 01-2

b. Connect oscillator to SWEEP INPUT on 8551B rear panel.

c. Adjust oscillator output for 100 cycles at 2.00 volts rms.

d. Measure the voltage on the rear terminal of TUNE potentiometer R5 (see Figure 5-21). At each setting of the SPECTRUM WIDTH switch, compare the voltage measured with the voltages given in Table 5-28.

e. Return SPECTRUM WIDTH to 200 MC/CM, and check voltmeter readings against FREQUENCY (GC) settings as indicated in Table 5-29.

f. In the event of a fault, refer to Tables 4-1 and 4-2 and to Figure 4-12 for a breakdown of the switching logic and helix control input functions.

5-140. Troubleshooting Converter Assembly A9.

5-141. Converter Assembly A9 includes 180MC Oscillator A9A3, 180MC Buffer Amplifier A9A4, 200MC IF Amplifier A9A1, and 200MC-20MC Mixer A9A2. To check 180-Mc oscillator for noise, connect oscilloscope at point 2, Figure 7-17A.

5-142. Problems can be isolated to 180-Mc oscillator and buffer by measuring power output at J25 (see Figure 5-6). Output power should be at least +18 dBm.

a. In general, low power is caused by tube aging.

b. In the event of total loss of power, localize to the faulty component by making voltage checks.

5-143. To check for proper operation of the 200-Mc IF amplifier and mixer, measure the gain. Input and output connectors (200MHZ INPUT and IF OUTPUT) are available on the rear panel. Gain should exceed 26 dB.

a. Loss of gain may be due to tube aging.

b. In the event of total loss of power, localize to the faulty component by making voltage checks.

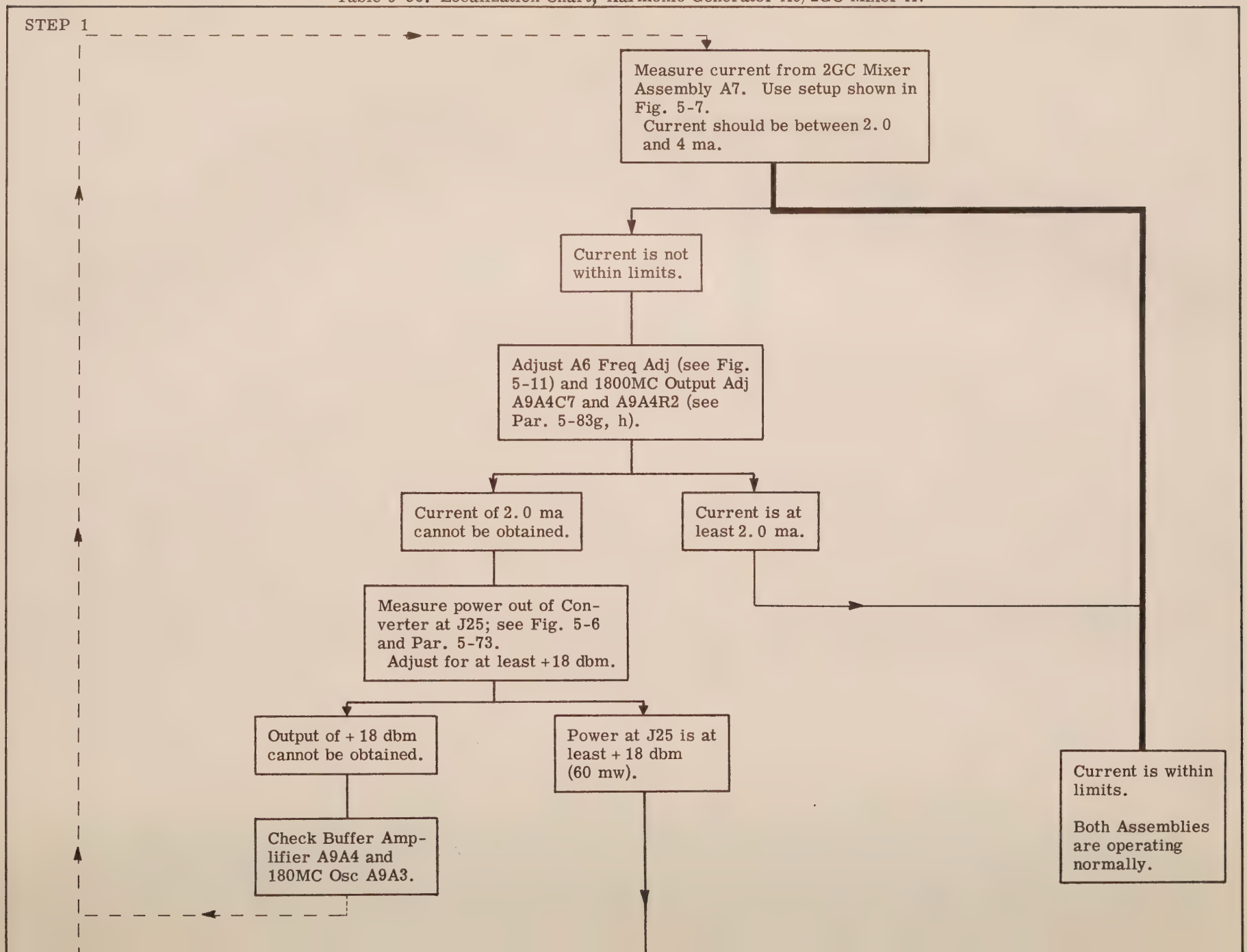
Table 5-28. Test Data for SPECTRUM WIDTH Check

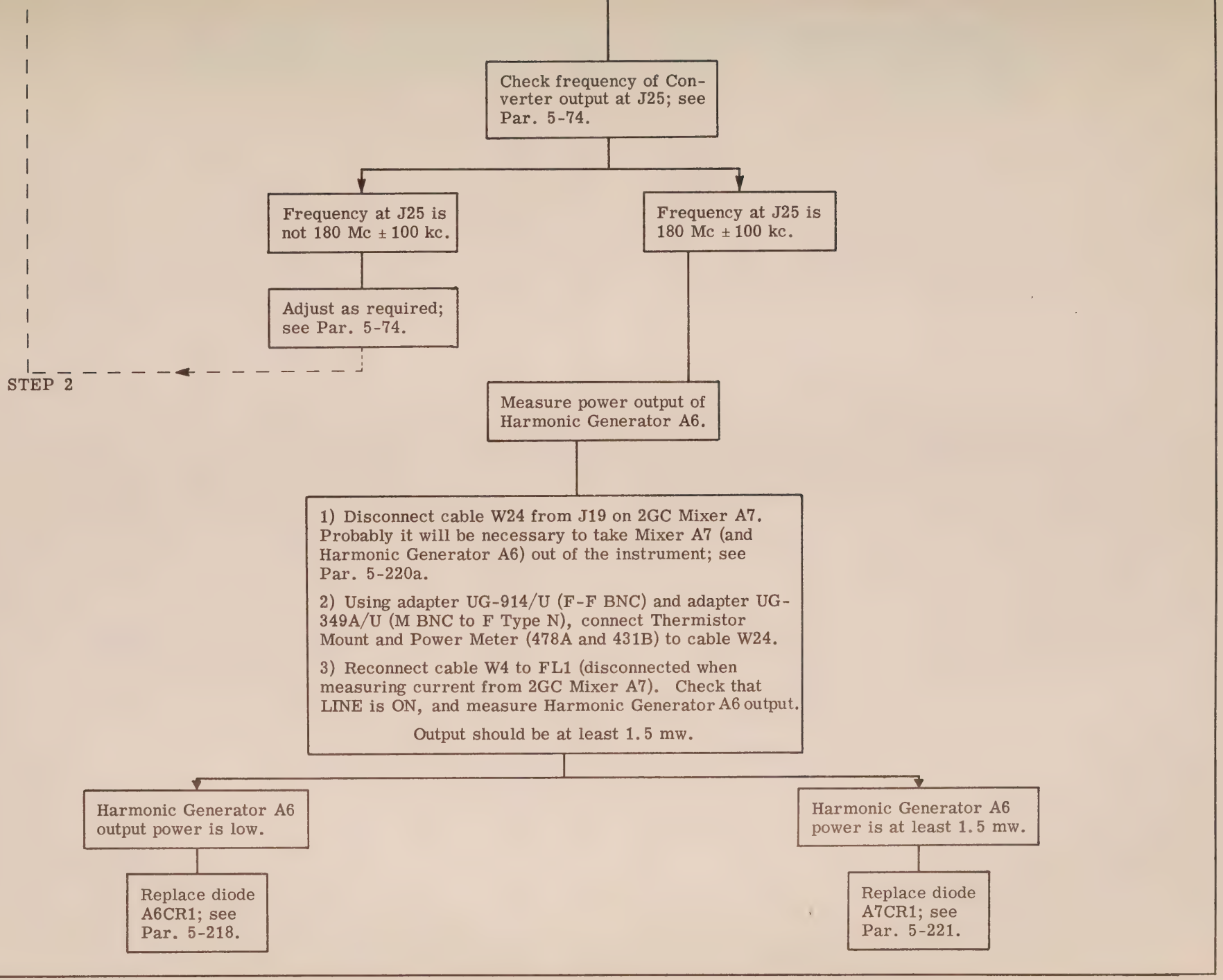
SPECTRUM WIDTH Setting	TEST LIMITS (V rms)
200 MC/CM	18.0 - 22.0
100 MC/CM	9.0 - 11.0
30 MC/CM	2.70 - 3.30
10 MC/CM	0.90 - 1.10
3 MC/CM	0.270 - 0.330
1 MC/CM	0.090 - 0.110
300 KC/CM	0.0270 - 0.0330
100 KC/CM	0.0090 - 0.0110
30 KC/CM	0.00270 - 0.00330
10 KC/CM	0.00090 - 0.00110

Table 5-29. Test Data for 1/n Attenuator Check

FREQUENCY (GC) Setting	TEST LIMITS (V rms)
.01 - 2	18.0 - 22.0
2 - 10	9.0 - 11.0
4 - 12.4	6.0 - 7.2
1.8 - 4.2	18.0 - 22.0
8 - 18	4.5 - 5.5
12 - 26	3.0 - 3.7
22 - 42	1.8 - 2.2

Table 5-30. Localization Chart, Harmonic Generator A6/2GC Mixer A7




Check frequency of Converter output at J25; see Par. 5-74.
Frequency at J25 is not 180 Mc ± 100 kc.
Frequency at J25 is 180 Mc ± 100 kc.
Adjust as required; see Par. 5-74.
STEP 2
Measure power output of Harmonic Generator A6.
1) Disconnect cable W24 from J19 on 2GC Mixer A7. Probably it will be necessary to take Mixer A7 (and Harmonic Generator A6) out of the instrument; see Par. 5-220a.
2) Using adapter UG-914/U (F-F BNC) and adapter UG-349A/U (M BNC to F Type N), connect Thermistor Mount and Power Meter (478A and 431B) to cable W24.
3) Reconnect cable W4 to FL1 (disconnected when measuring current from 2GC Mixer A7). Check that LINE is ON, and measure Harmonic Generator A6 output.
Output should be at least 1.5 mw.
Harmonic Generator A6 output power is low.
Harmonic Generator A6 power is at least 1.5 mw.
Replace diode A6CR1; see Par. 5-218.
Replace diode A7CR1; see Par. 5-221.

5-144. Troubleshooting Harmonic Generator Assembly A6 & 2GC Mixer Assembly A7.

5-145. If there is trouble in either Harmonic Generator A6 or 2GC Mixer A7, generally the cause is the diode. The localization procedure in Table 5-30 will check out these assemblies.

5-146. Troubleshooting 2GC IF Amplifier A5.

5-147. The 2-Gc IF amplifier can be checked by measuring its gain.

a. Set FREQUENCY(GC) to 8-18.

b. Connect 2-Gc signal at -30 dBm to EXT MIXER INPUT.

c. Connect power meter to 2GC OUTPUT (J3).

d. Tune signal generator for maximum output on power meter.

e. The gain through the 2-Gc IF amplifier should be at least 10 dB. If gain is low, try retuning the cavity (Paragraph 5-92); if the gain is quite low, Amplifier A5V1 should be replaced (Paragraph 5-197).

5-148. Troubleshooting Phase Lock Loop.

5-149. GENERAL.

5-150. WORKING ON LOCK ASSEMBLY A15.

a. Preparation. After removing top cover from 8551, remove Converter Assembly A9.

b. 10MC Osc/Disc. 10-Mc Oscillator/Discriminator A15A1 may be worked on simply by removing top cover from lock assembly. Before removing cover, unsolder wire which projects through casting and is soldered to lug on top cover.

c. Pulse Amplifier. See Paragraph 5-96a through h.

5-151. SECTIONALIZATION. For troubleshooting purposes, the phase-lock loop can be broken down as follows: 1) 10-Mc Oscillator Drive A14V1A, A14V1B; 2) 10-Mc Voltage-Tuned Oscillator/Discriminator A13V2B, A13V5, and all of A15A1; 3) Sampler Assembly A23; 4) Pulse Amplifier Assembly A15A4; and 5) Search Oscillator/Differential Amplifier A14Q1, A14Q2, and A14Q3.

5-152. 10-MC OSCILLATOR DRIVE.

5-153. Voltages and waveforms appear on the schematic diagram, Figure 7-26. The waveforms at test points 12 and 13 also are shown in Table 7-1.

5-154. 10-MC VOLTAGE-TUNED OSCILLATOR/DISCRIMINATOR.

5-155. The 10-Mc VTO/discriminator (Figure 7-26) form a feedback loop, so a fault anywhere can affect all parts of the circuit. Table 5-31 is a Localization Chart for locating trouble in the feedback loop.

5-156. SAMPLER ASSEMBLY A23.

5-157. The sampler assembly can be checked by disconnecting the assembly at J29 (Paragraph 5-217 a) and measuring the output voltage (refer to Paragraph 5-96, steps y and z). Check the diodes (Paragraph 5-216) if the output voltage is low.

5-158. PULSE AMPLIFIER.

5-159. Troubles in Pulse Amplifier Assembly A15A4 are most easily located using an artificial input signal. Disconnect Sampler Assembly A23 for the Pulse Amplifier Input J29, and at J29 inject a -35 dBm 10-Mc signal, amplitude-modulated 20% at 1000 cps. Observe the signal at pulse amplifier output A15TP2; it should be approximately a 400-mV peak-to-peak, 1000-cycle signal. If the signal is faulty, check waveforms throughout the pulse amplifier. If the signal at pulse amplifier output A15TP2 is normal check the signal at J30. The signal here should be a 1000-cps signal with an amplitude about half that noted at pulse amplifier output A15TP2. If this waveform is faulty, check A15A4Q6 and A15A4Q7.

5-160. Excessive residual signals:

a. If residual is at 10, 20, or 30 Mc, cause can be ineffective filtering of the ±15 Vdc input to Pulse Amplifier A15A4. Check filter components; networks are shown in Figure 7-29, and component location in Figure 7-24.

b. If residual is at a frequency other than 10, 20, or 30 Mc, source probably is external to Lock Assembly A15.

(1) Check Harmonic Generator A6 for 180 Mc ±20 kc; see Figure 5-7 and Paragraph 5-83b, c.

(2) Check noise figure of 2GC Mixer A7; see Paragraph 5-90.

(3) Check noise figure of 2GC IF Amplifier A5; see Paragraph 5-91.

5-161. 7-CPS OSCILLATOR/DIFFERENTIAL AMPLIFIER.

5-162. These circuits can be checked for operation by observing the front panel meter. With STABILIZATION set to UNSTABILIZED, the front panel meter should oscillate at about 7 cps with an amplitude of about the width of the meter pointer. If search oscillator is not functioning, before checking A14Q1-Q3, check adjustment of SEARCH OSC GAIN ADJ A14R22 (Paragraph 5-96am).

5-163. Relay Checks.

5-164. HELIX OVERLOAD RELAY K4.

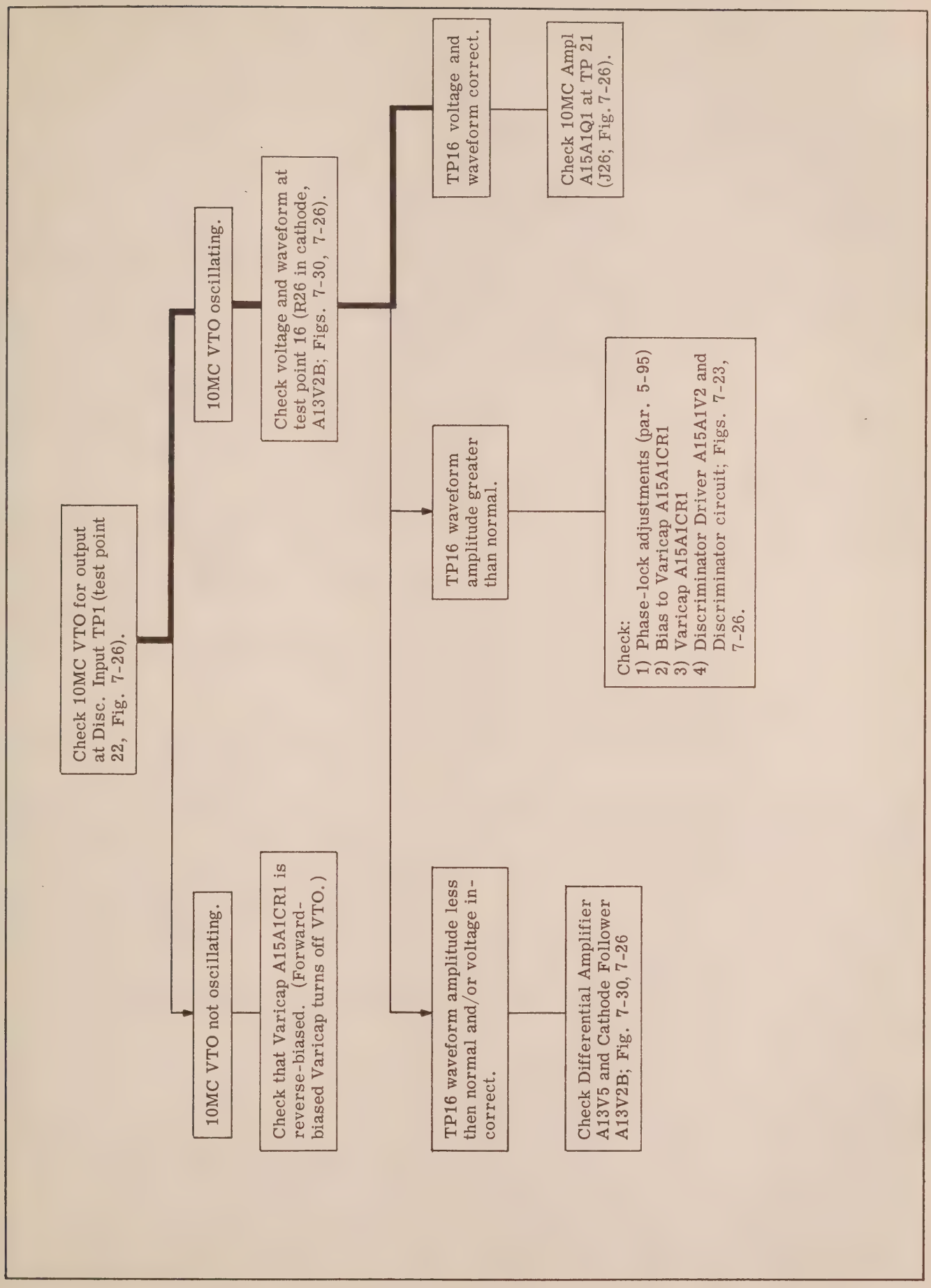
5-165. EQUIPMENT REQUIRED.

a. Clip-On DC Milliammeter (428A): item 4 in Table 5-1.

b. Variable transformer; item 3 in Table 5-1.

c. Soldering iron; item X in Table 5-2.

Table 5-31. Localization Chart, 10MC Voltage-Tuned Oscillator/Discriminator



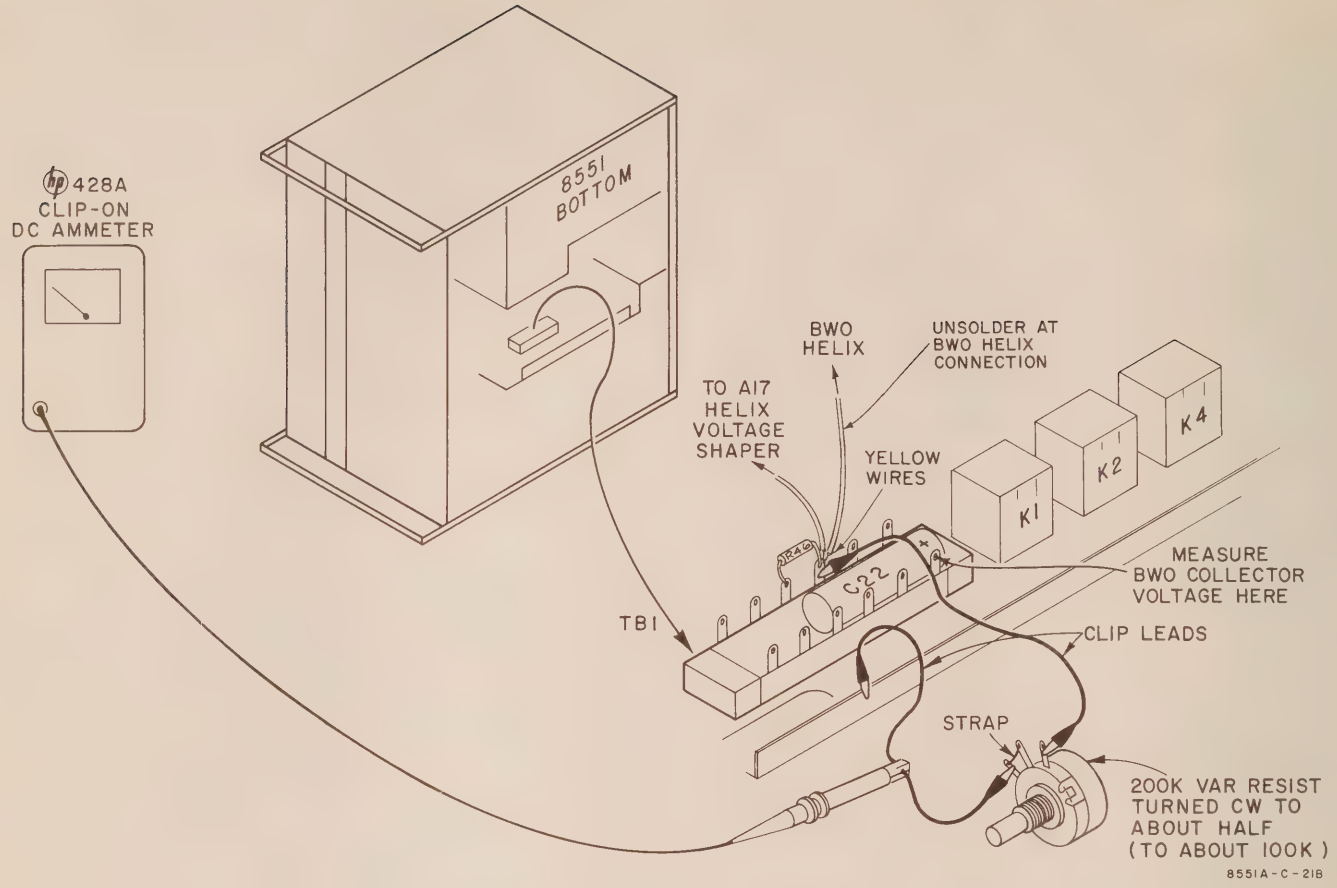


Figure 5-22. Setup for Checking Helix Overload Relay K4, 8551

d. Variable resistors, 200K, 2W; item W in Table 5-2.

e. Clip leads, 2 each, 10-inch or longer.

5-166. SETUP. See Figure 5-22.

a. Set 8551:
LINE . . . . . OFF
TUNE . . . 2 Gc on LOCAL OSC FREQ scale

b. Rest 8551 on left side, and remove bottom plate. Locate Terminal Board TB2 (see Figure 7-3).

c. Ad indicated in Figure 5-22, two yellow color-coded wires are connected to the fourth terminal of TB2 on the inside row. Unsolder the yellow wire that goes to the BWO helix; at the connection of the BWO (see Figure 5-19).

d. Before connecting variable 200K resistor to TB2 fourth terminal:

(1) Strap one end terminal to center terminal; these instructions assume strapping as indicated in Figure 5-22.

(2) With resistor position as shown in Figure 5-22, turn shaft clockwise to about midpoint of range (to about 100 K).

e. Using clip leads, connect resistor between TB2 fourth terminal and chassis ground. Slip ammeter probe around one of the clip leads, or connect a conventional ammeter in series.

f. Connect 8551 to line voltage through variable transformer set for about 115 volts.

5-167. PROCEDURE.

a. Set 8551 LINE to ON.

b. While watching ammeter, reduce resistance of external variable resistor until Relay K4 operates. (Ammeter should read between 6.0 and 6.5 mA when Relay K4 operates.)

c. Disconnect external variable resistor, and resolder BWO helix wire. It may be necessary to clean solder from lug in order to reconnect helix wire.

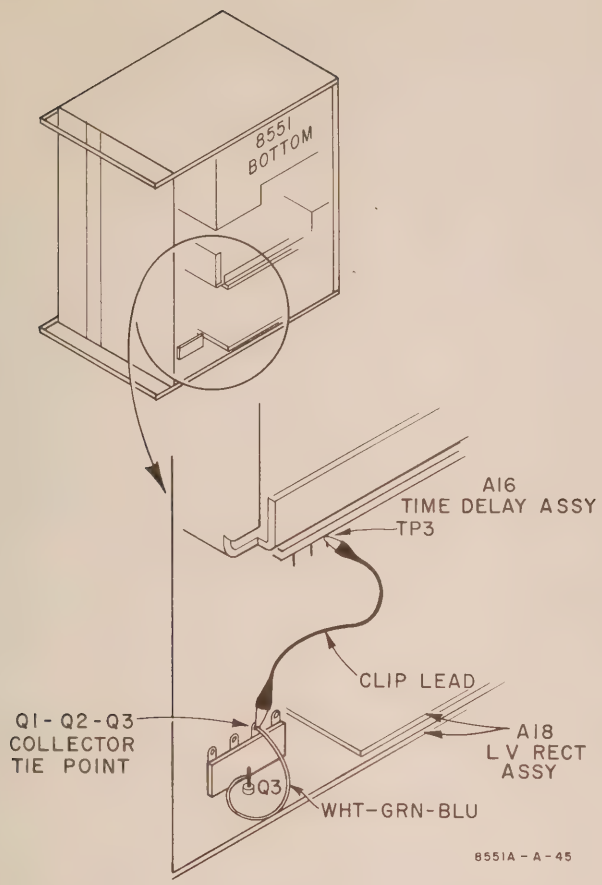


Figure 5-23. Shorting out LV Series Regulator Q1-Q2-Q3 for 8551 Relay K3 Check

5-168. FILAMENT OVER VOLTAGE RELAY K3.

a. Equipment Required: clip lead.

b. Procedure.

(1) Short out -6.3 V Series Regulator Q1-Q2-Q3 by attaching a clip lead from the Q1-Q2-Q3 tie point on Assy A18 to -6.3 (TP3) on HV TD Assy A16; see Figure 5-23.

(2) Set variable transformer for 103.5 V and 8551 LINE to ON.

(3) Filament Over Voltage Relay K3 should operate. Relay K3 is located right behind HV TD Assy A16, and is called out in Figure 7-3.

(4) Remove clip lead.

(5) Set LINE to OFF.

5-169. TIME DELAY RELAY K1.

a. Locate relay K1. (See Figure 5-22.)

b. While noting the time, switch LINE to ON.

c. Note time when K1 operates. (K1 should operate from 60 to 90 seconds after LINE is set to ON.)

d. Set LINE to OFF.

5-170. PARTS LOCATION.

5-171. The key to parts locations is in the part designation.

a. If a component is mounted on an assembly board, the designation is prefixed with the assembly number, e.g., A1R5. Location of each assembly is called out in Figures 7-2 and 7-3. In addition, a picture of each assembly board is provided, and all components on the board are identified. For the most part, board pictures face the schematic in which the assembly appears. All board pictures are listed in the List of Illustrations.

b. If a component is mounted on the chassis, the designation has no prefix, e.g., R5. Since these parts are harder to locate, a locator list, Table 7-2, has been prepared that gives information on how to locate the part.

5-172. CIRCUIT BOARD EXTENDERS.

5-173. Three extenders, two 15-pin extenders and a 22-pin extender, are shipped with the 8551 RF Section. These extenders, supplied for use when troubleshooting boards such as Helix Control Assembly A13, Sampler/Search Board A14, or LV Power Supply A19, make it possible to extend the board from the instrument for easy access to components and terminals.

5-174. TROUBLESHOOTING TRANSISTORS.

5-175. The following general information is provided for those who may not have had extensive experience with transistors.

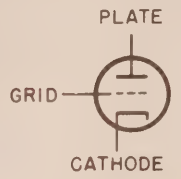
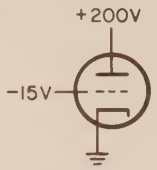
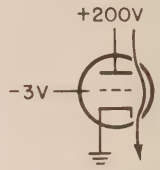
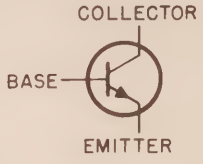
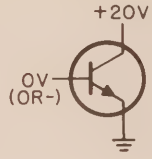
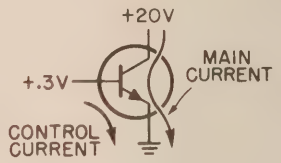
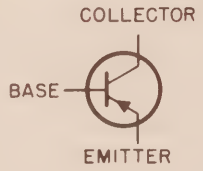
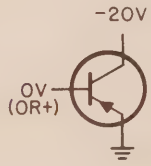
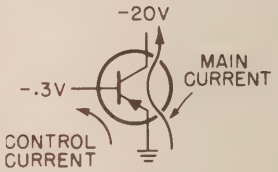
5-176. In transistor testing the most important consideration is the base-emitter junction; like the control grid of a vacuum tube, this is the operation control point in the transistor. The junction is essentially a solid state diode, and for the transistor to conduct this diode must be forward-biased.

5-177. Bias polarity for cutoff and conduction of vacuum tubes as well as transistors is also shown in part A of Figure 5-24. Part B shows simplified versions of the three basic transistor circuits, and gives the amplifier characteristics of each.

5-178. IN-CIRCUIT TESTING.

a. When checking a transistor stage, first determine if the emitter-base junction is forward-biased. Do not place an electronic voltmeter directly across the junction to measure the voltage difference; there could be sufficient loop current between the voltmeter leads to damage the transistor. Instead, measure each voltage separately with respect to a common point (e.g., chassis). If junction is not forward-biased, and power supply voltages are known to be correct, the base-emitter junction may be open (see Paragraph 5-179).

A. TRANSISTOR BIASING

DEVICE	SYMBOL	CUT OFF	CONDUCTING
VACUUM TUBE			
N P N TRANSISTOR			
P N P TRANSISTOR			

B. AMPLIFIER CHARACTERISTICS

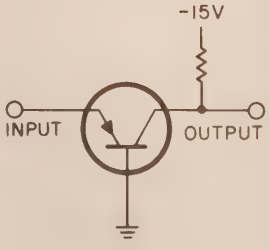
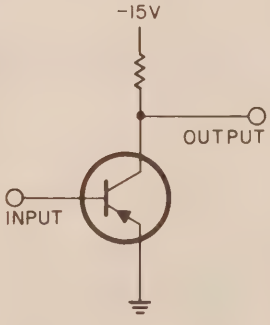
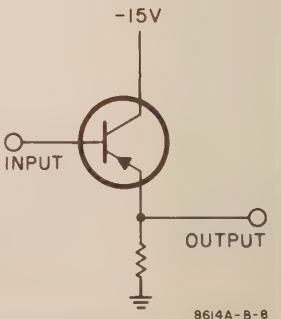
CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
INPUT Z	30-50 Ω	500-1500 Ω	20-500K Ω
OUTPUT Z	300-500K Ω	30-50K Ω	50-1000 Ω
VOLTAGE GAIN	500-1500	300-1000	< 1
CURRENT GAIN	< 1	25-50	25-50
POWER GAIN	20-30 db	25-40 db	10-20 db
			

Figure 5-24. Transistor Biasing and Typical Amplifier Characteristics

Table 5-32. Typical Data for Out-of-Circuit Transistor Resistance Measurement

Transistor Type		Connect Ohmmeter		Measure Resistance (ohms)
		Positive lead to	Negative lead to	
PNP Germanium	Small Signal	emitter	base*	200-500
		emitter	collector	10K-100K
	Power	emitter	base*	30-50
		emitter	collector	several hundred
NPN Silicon	Small Signal	base	emitter	1K - 3K
		collector	emitter	very high (might read open)
	Power	base	emitter	200-1000
		collector	emitter	high, often greater than 1M

*To check collector, short collector to base; resistance should decrease.

b. If the emitter-base junction is forward-biased, check for amplifier action by short circuiting base to emitter while observing collector voltage. The short eliminates base-emitter bias and should cause the transistor to stop conducting. Collector voltage should then shift to near the supply voltage. Any difference is due to leakage current through the transistor, and, in general, the smaller this current, the better the transistor. If collector voltage does not change, the transistor either has an emitter-collector short circuit or emitter-base open circuit.

5-179. OUT-OF-CIRCUIT TESTING WITH OHMMETER. If a short or open circuit is suspected, remove the transistor from the circuit and use an ohmmeter to measure internal resistance. See Table 5-32 for typical measurement data.

CAUTION

Most ohmmeters can supply enough current or voltage to damage a transistor. Before using the ohmmeter, check ohmmeter open-circuit voltage and short-circuit current output ON THE RANGE TO BE USED. Open-circuit voltage must not exceed 1.5 volts and short-circuit current must be less than 3 mA. See Table 5-33 for safe resistance ranges for some common ohmmeters.

5-180. REPAIR & REPLACEMENTS.

5-181. The information provided in this part of the Manual is briefly indexed in Table 5-34.

5-182. Backward Wave Oscillator Tube.

5-183. OLDER BWO TUBE.

5-184. If warranty period has expired and BWO performs satisfactorily except that power output is low, before replacing BWO try increasing power output to approximately 20 mW by increasing anode voltage.

5-185. EQUIPMENT REQUIRED.

a. Power Meter and Thermistor Mount (431B & 478A): item 15 in Table 5-1.

b. Fixed 20-dB Attenuator (8491A Option 20): item 16 in Table 5-1.

c. Clip-On Milliammeter (428B): item 4 in Table 5-1.

d. Clip leads, 2 each, 10-inch or longer.

Table 5-33. Safe Ohmmeter Ranges for Transistor Resistance Measurements

Ohmmeter	Safe Range(s)	Open Circuit Voltage	Short Circuit Current	Color	Polarity
hp 412A	R x 1K	1.0V	1 ma	Red Black	+ -
	R x 10K	1.0V	100 μa		
	R x 100K	1.0V	10 μa		
	R x 1M	1.0V	1 μa		
	R x 10M	1.0V	0.1 μa		
hp 410C	R x 1K	1.3V	0.57 ma	Red Black	+ -
	R x 10K	1.3V	57 μa		
	R x 100K	1.3V	5.7 μa		
	R x 1M	1.3V	0.5 μa		
	R x 10M	1.3V	0.05 μa		
hp 410B	R x 100	1.1V	1.1 ma	Black Red	+ -
	R x 1K	1.1V	110 μa		
	R x 10K	1.1V	11 μa		
	R x 100K	1.1V	1.1 μa		
	R x 1M	1.1V	0.11 μa		
Simpson 260	R x 100	1.5V	1 ma	Red Black	+ -
Simpson 269	R x 1K	1.5V	0.82 ma	Black Red	+ -
Triplett 630	R x 100	1.5V	3.25 ma	Varies with Serial Number	
	R x 1K	1.5V	325 μa		
Triplett 310	R x 10	1.5V	750 μa		
	R x 100	1.5V	75 μa		

Table 5-34. Repair and Replacement Information

Subject	Paragraph	Table
A1, replacement of resistor cards	5-200	
A2CR1, replacement of	5-213	
A3CR1, replacement of	5-191	
A3R1, replacement of	5-194	
A5V1, replacement of	5-197	
A6CR1, replacement of	5-218	
A7CR1, replacement of	5-221	
A20Q1-A20Q6, replacement of	5-228	
A23, checking and replacing diodes	5-214	
Q1-Q6, replacement of	5-227	5-35
R5, resistance of	5-226	
R6-R7, replacement of	5-205	
BWO		
Older tube	5-183	
Replacement	5-187	
Warranty information	5-188	
Etched circuits		
Soldering equipment		5-36
Working on	5-238	
Freeing front panel	5-229	
Frequency-scale drum alignment	5-234	
Gain-Compensating switch S4	5-208	
INPUT connector J1	5-225	
Parts Locator		7-2
Removing switches	5-236	
Replacement information, general		
Components	5-241	
Transistors	5-240	
Transistor replacement, adjustments required following		5-37
Tube replacement, adjustments required following		5-38

5-186. PROCEDURE.

WARNING

In working near the BWO leads, always remember that dangerously high voltages are present on some of these leads.

a. Disconnect 8551 from ac line.

b. Note connections to BWO outputs:

(1) Cable W32 is connected between Connector A (J32) on the BWO and Circulator AT1.

(2) Cable W18 is connected between Connector B (J31) on the BWO and Coaxial Mixer Assembly A3.

c. The following procedure should be performed at each BWO output; leave the cable connected to the other BWO output so the tube will be properly terminated.

(1) Disconnect cable from either BWO output, and connect power meter and thermistor mount via 20-dB coaxial attenuator.

(2) Reconnect 8551 to ac line, check that LINE is at ON, and set SPECTRUM WIDTH VERNIER maximum ccw (no sweep).

(3) While monitoring with power meter, turn TUNE through its range from 2.0 to 4.0 Gc. Note and record minimum power frequency. Leave power meter connected to BWO output.

(4) Disconnect 8551 from ac line. Disconnect helix lead (yellow) from BWO, and reconnect lead to BWO via clip lead at least 10 inches long (to accommodate clip-on milliammeter). Reconnect 8551 to ac line.

(5) While monitoring helix current with Clip-On Milliammeter (428B), adjust BWO Anode Adj A16R8 (Figure 7-33) for power meter reading of approximately 20 mW.

Note

The 20-mW output must be obtained without the helix current exceeding 4 mA.

d. If BWO Anode Adj A16R8 can be set to obtain approximately 20 mW at each output, perform BWO Frequency Calibration Procedure, Paragraph 5-58.

5-187. BWO REPLACEMENT.

5-188. WARRANTY. The BWO manufactured by the Stewart Division of Watkins Johnson is warranted for 2500 hours of filament operation or one year, whichever period ends first. If the BWO fails within this period, see the Warranty Claim and Adjustment Procedure at the rear of this Manual. Always detach and return Elapsed Time Meter A18M1 mounted on LV Rectifier Assembly A18 (Figure 7-36) when returning BWO for warranty adjustment.

Note

When ordering a replacement BWO, always order a replacement A18M1 Elapsed Time Meter.

5-189. BWO REMOVAL.

a. Disconnect 8551 from ac line.

b. Remove top cover. Rest 8551 on left side, and remove bottom and right side plates.

c. Remove the 2 screws securing right handle assembly.

d. Remove clamp securing Cable W29 to center H-section of right side frame.

e. Remove the 8 machine screws (8-32 x 3/8 countersunk w/lockwashers) securing center H-section of right side frame.

f. Unsolder the 6 leads at rear of BWO tube and disconnect the 2 coaxial cables at front of tube.

g. Rotate 8551 so that bottom of instrument is facing up.

h. The BWO is fastened to a mounting plate and the mounting plate is secured to the chassis by 4 screws.

(1) Loosen the 4 mounting plate screws (10-24 x 5/8 RH, each w/split lockwasher and flat washer); remove BWO and mounting plate.

(2) The 4 screws (10-32 x 5/16 RH) which hold mounting plate to the BWO are accessible from rear of plate. Plate mounting holes are not symmetrical; note orientation of plate to BWO before removing plate.

5-190. BWO INSTALLATION.

a. Equipment Required.

(1) Clip-On Milliammeter (428B): item 4 in Table 5-1.

(2) DC Voltmeter (3440 or 410C): item 2 or 5 in Table 5-1.

(3) Power Meter and Thermistor Mount (431B & 478A): item 15 in Table 5-1.

(4) 20-dB Attenuator (8491A Option-20): item 16 in Table 5-1.

(5) Right-angle Adapter, Type N male-to-female connectors (UG-27C/U): item AB in Table 5-2.

b. Procedure.

(1) Disconnect 8551 from ac line.

(2) Fasten BWO to mounting plate removed in step h of Paragraph 5-189.

(3) Fasten BWO mounting plate to chassis with four screws removed in Paragraph 5-189h (1).

(4) Connect RF cables to the Type N connectors on tube front, making connections as noted in Paragraph 5-186b.

(5) Install Elapsed Time Meter A18M1 on LV Rectifier Assembly A18, positioning timing gap over time scale zero line.

WARNING

Be careful when working around or with the BWO leads; when the instrument is turned on, dangerously high voltages are present on these leads.

(6) Tape up or otherwise insulate all loose leads that are to be connected to the BWO.

(7) Reconnect 8551 to ac line, and check that LINE is at ON.

(8) Before connecting leads to BWO terminals, coarse-set anode voltage:

(a) Set TUNE to 2 Gc and SPECTRUM WIDTH VERNIER maximum ccw.

(b) At ANODE test point A16TP7 on HV Time Delay Assembly board A16 (see Figure 7-33) measure anode voltage and set Anode Adj A16R8 for within ±5 volts of anode voltage stamped on tube.

(9) Disconnect 8551 from ac line.

(10) Connect respective conductors to BWO terminals (see Figure 5-19), making connection through 10-inch or longer clip lead where specified.

Lead	Direct Connection	Clip Lead Connection
Anode (blue)	x	
Collector (white)	x	
Helix (yellow)		x
Cathode (black)		x
Heater (black)	x	
Heater (brown)	x	

(11) Reconnect 8551 to ac line. Set LINE to ON, and before proceeding allow a few minutes BWO warm-up time after ON light glows.

(12) Set TUNE to 2 Gc on LOCAL OSC FREQ scale and SPECTRUM WIDTH VERNIER maximum ccw.

(13) Note cathode current stamped on side of BWO tube. Using clip-on milliammeter, monitor BWO cathode current while adjusting anode voltage with BWO ANODE ADJ A16R8. Connect dc voltmeter at ANODE test point A16TP7 on HV Time Delay Assy A16 (see Figure 7-33). Adjust BWO ANODE ADJ A16R8 for cathode current stamped on BWO.

(14) At each BWO output, in turn, connect equipment as described in Paragraph 5-186a through c (2), and turn TUNE through its range (2- to 4-Gc) to find minimum-power frequency.

(15) Using clip-on milliammeter, monitor BWO helix current while adjusting BWO ANODE ADJ A16R8 for 20 mW output at minimum-power frequency without exceeding helix current maximum of approximately 4 mA.

Note

Excessive helix current actuates Helix Overload Relay K4, operation of which disconnects BWO operation voltages. To reconnect voltages, set LINE to OFF, and then to ON. After a delay of at least 1 minute, operating voltages are reconnected to BWO.

(16) If desired, transfer milliammeter to cathode lead and check current with anode at voltage set in step (15). Current should be approximately value stamped on tube.

(17) Perform BWO Frequency Calibration; see Paragraph 5-58.

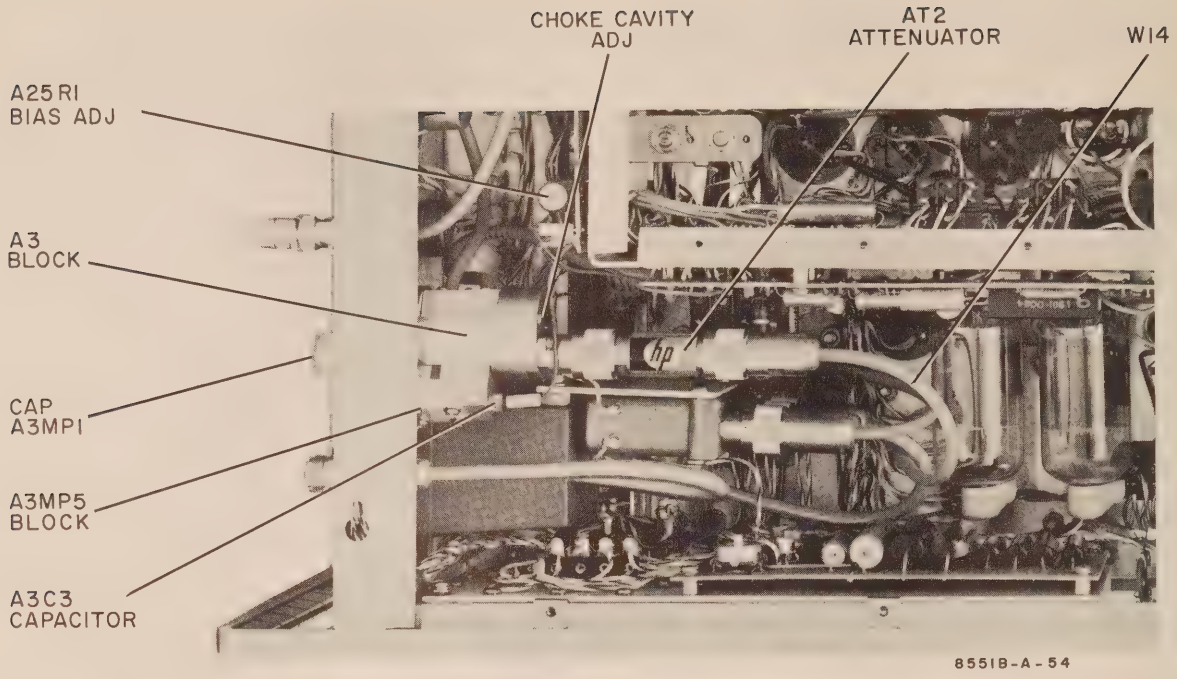


Figure 5-25. Arrangement of Coax Mixer A3

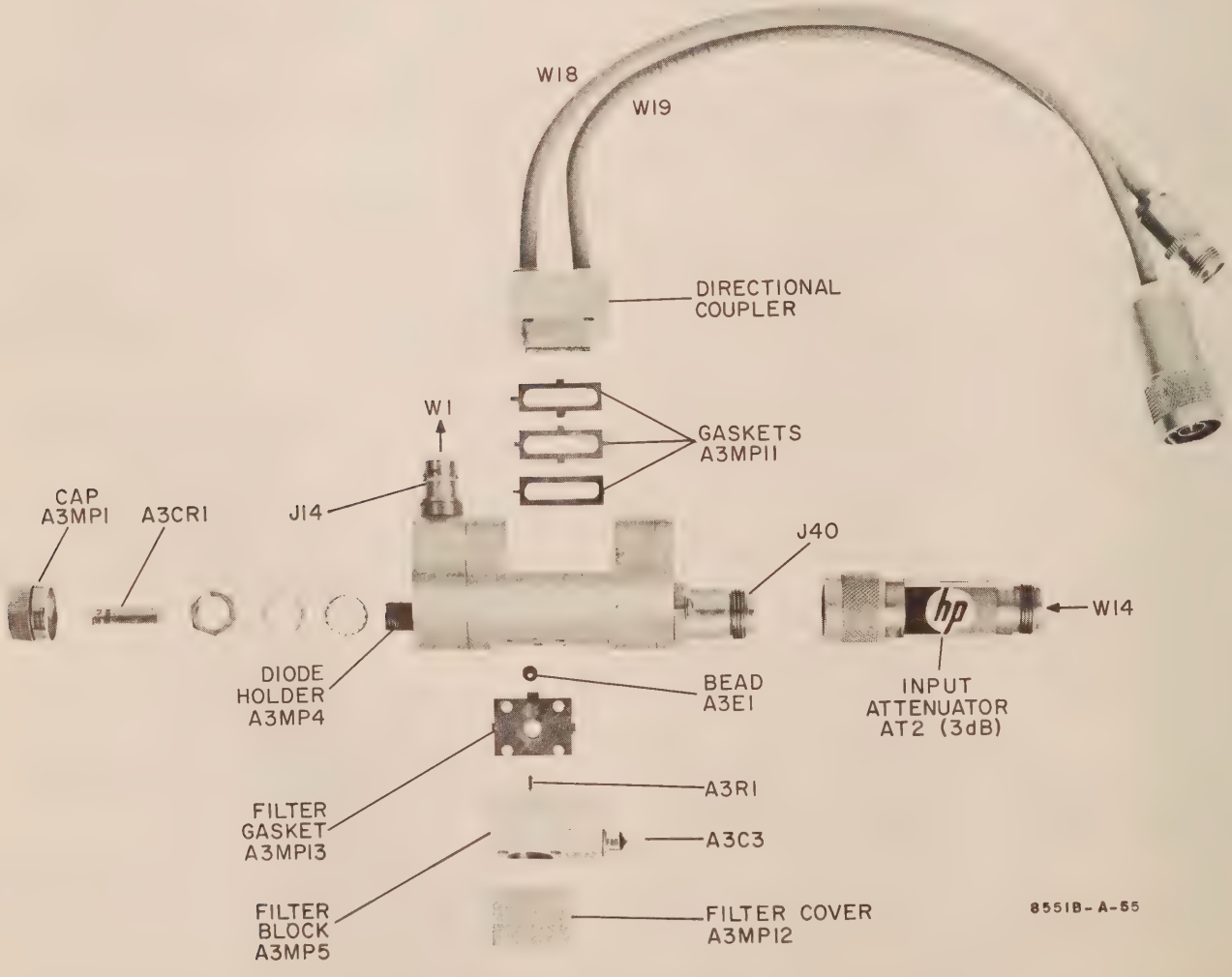


Figure 5-26. Coaxial Mixer Assembly A3, Exploded View

5-191. Replacement of Diode A3CR1.

5-192. Replacement of A3CR1 is accomplished from the front panel of your instrument. The HP stock number and manufacturer's part number for Diode A3CR1 are listed in Tables 6-1 and 6-4.

5-193. Replace as follows:

a. Set LINE switch to STANDBY.

b. Remove Mixer Diode Cap A3MP1 (Figure 5-26).

c. Extract Diode A3CR1 and replace with serviceable diode.

d. Replace cap A3MP1.

e. Set LINE switch to ON.

f. Check sensitivity (Paragraph 5-23).

5-194. Replacement of Resistor A3R1.

5-195. CHECKING A3R1. At the lower settings of ATTENUATOR(DB), a defective A3R1 will affect:

a. Analyzer sensitivity

b. Accuracy of ATTENUATOR(DB) switch.

c. Input SWR.

To check A3R1 proceed as follows:

(1) Set LINE switch to OFF.

(2) Remove Diode A3CR1 (see Paragraph 5-191).

(3) Set FREQUENCY(GC) switch to 2-10.

(4) Insert blade of small screw driver in diode holder making contact with center conductor A3MP10 (Figure 6-3).

(5) Measure resistance between center conductor and chassis ground (see Figure 7-15). Resistance should be 1000 ohms.

5-196. REPLACEMENT PROCEDURE (Figure 5-25).

a. Disconnect 8551 from line. Turn instrument so it rests on left side; remove bottom plate.

b. Disconnect bias generator lead at A3C3 (see Figure 5-25).

c. Remove mixer diode cap and Diode A3CR1.

d. Remove hex nut securing Mixer Diode Assembly A3 to instrument front panel.

e. Remove machine screws (4) securing Filter Block A3MP5 to mixer body (Figure 5-26).

f. Pull filter block from mixer body.

(1) Watch for a polyiron bead that can drop out, and place it in a safe place.

(2) Place screws, washers, filter cover and gasket in a safe place.

(3) Note orientation of A3R1 in relation to Filter Block A3MP5.

g. Removal of A3R1:

(1) Before removing, note that the free lead of A3R1 has been trimmed to approximately 3/32-inch.

(2) Unsolder and remove A3R1.

h. Trim leads of replacement A3R1 to 3/16 and 3/32-inches of resistor body.

i. Insert 3/16-inch lead of A3R1 in A3C2 and solder.

j. Body of A3R1 must extend 0.250 ±0.005 inch from Filter Block A3MP5 for correct positioning when seated in mixer body.

k. Place Filter Gasket A3MP13 on filter block and position Polyiron Bead A3E1 over A3R1. Center bead and resistor in relation to hole in gasket.

m. Assemble filter block to mixer body. Free end of A3R1 mates with clip in center conductor. Check for a slight resistance to both in and out movement after resistor lead engages clip.

n. Secure filter block to mixer body and perform resistance measurement contained in Paragraph 5-195. Return Mixer A3 to instrument and install Diode A3CR1.

5-197. Replacement of A5V1.

5-198. TUBE REMOVAL.

a. Remove top cover of 8551B; 2GC IF Amplifier Assembly A5 is at rear of instrument (see Figure 7-2). Note that all three adjustment screws line up across top of assembly.

b. Disconnect Cable W22 from Assembly A5 (Figure 7-6).

c. On rear panel:

(1) If cable is connected to 2GC OUTPUT, disconnect it.

(2) Remove four 8-32 x 3/8" machine screws (with integral lockwashers) which hold Assembly A5 to rear panel; these screws are accessible from rear panel.

d. Gently lift A5 out of chassis, being careful not to put strain on wires soldered to end plate; it is not necessary to unsolder these wires as sufficient slack is allowed for tube removal procedures.

CAUTION

Never remove either end plate on A5. End-plate removal causes internal damage which will make assembly inoperable.

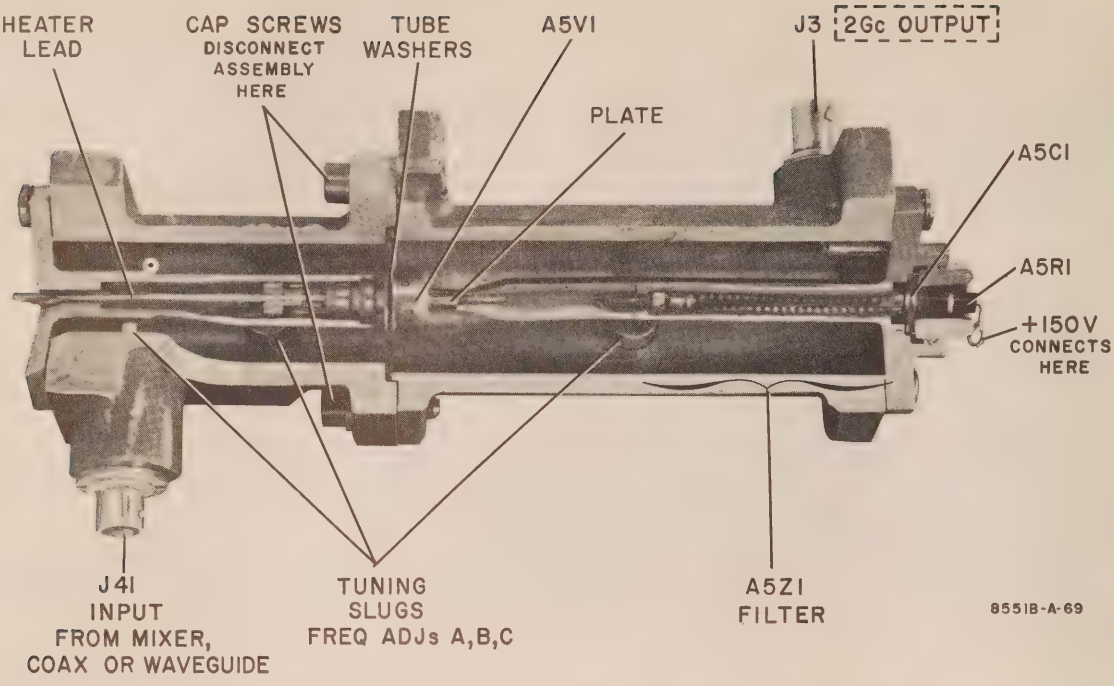


Figure 5-27. 2GC IF Amplifier Assy A5, Cutaway View

e. The two sections of A5 are fastened together with four 8-32 x 1/2" cap screws. Remove these screws with 1/8" Allen wrench. (Place screws and associated #8 split lockwashers in safe place.) The two sections of A5 part as soon as screws are removed; the tube, held in a socket at the heater end, remains in the lower section.

f. Contact between casting and tube is via two large washers. Probably the top plate washer will drop out when the two sections of A5 separate. Examine the washer, and note that washer is slightly concave; the concave side goes toward the tube. Note that other washer is under one edge of tube.

g. Tube heater is held securely in a socket, and probably long-nose pliers will be required to pull tube out. Grasp tube by plate (see Figure 5-27), and pull tube straight out. Note that concave side of other plate washer also is toward the tube. (This washer may drop out, but there is no need to remove it.)

5-199. TUBE INSTALLATION.

Note

If bottom washer dropped out, fit washer on tube, concave side toward tube, before installing tube.

a. To install tube, grasp plate end with long-nose pliers, and fit heater end into socket. Tube goes into socket hard; after finding socket with heater end, press down on tube firmly with both thumbs -- tube will snap into place.

b. Place other washer on tube, concave side toward tube.

c. Orient the two sections so adjustment screws line up (arrangement of screws was noted in Paragraph 5-198a). Then fit plate of tube into its socket, and rotate formed edge of casting into recess where tube washers sit.

d. Fasten assembly together with screws removed in Paragraph 5-198e. Before fastening screws, be sure that sections are oriented so adjustment screws line up. Turn screws in tightly.

e. Check tuning of 2GC IF Amplifier; see Paragraph 5-91.

5-200. Resistor Card Replacement, Input Attenuator Assembly A1.

5-201. Resistor cards in ATTENUATOR(DB) can be damaged if more than 1 watt is applied to INPUT. Among the indications of damage are loss of sensitivity and loss of frequency response flatness. If a card requires replacement, the card, installed in its cartridge, can be ordered and the cartridge-resistor card assembly replaced in the field (see Paragraph 5-203). Part numbers for the cartridge-resistor card assemblies are listed in Table 6-1 under A1R1-A1R6.

5-202. REMOVAL.

a. Disconnect 8551 from line. Turn instrument so it rests on top plate; remove bottom plate. Note orientation of attenuator assembly; bracket is toward inside of instrument, and solder terminals on coax switch are not exposed with 8551 bottom plate removed.

b. Remove the two Allen setscrews which secure ATTENUATOR(DB) knob to shaft, and slip knob off shaft; setscrews take a No. 8 Allen wrench.

c. On Coax Switch A22K1, disconnect Cable W14 from Connector J37 and Cable W15 from Connector J38. Disconnect white-black-yellow conductor at clip connection to Connector A18B2.

d. With 1/2-inch wrench, remove Bushing A1MP1 (Figure 6-1) which secures shaft to front panel. There are three lockwashers (A1MP7 and A1MP8) between the attenuator and the instrument panel. Pull attenuator shaft out of panel and remove the lockwashers.

e. Unsolder black and white conductor from terminal on Coax Switch A22K1. Remove coax switch from attenuator assembly.

f. Loosen J1 connector body (Figure 6-1) from Connector Shell W13MP4. Rotate connector body, Cable W13 and the entire attenuator assembly simultaneously until body, Center Conductor W13MP1, Insulator W13MP2 and Center Pin W13MP3 are free of Connector Shell W13MP4. Do not rotate connector body independent of W13 Cable as conductor inside cable will shear.

Note

Examine attenuator shaft; if scored, shaft will have to be filed smooth before turret assembly can be removed from housing.

5-203. CARTRIDGE-RESISTOR CARD REPLACEMENT.

a. Remove four Screws A (Figure 5-28) and associated washers. Screws A are 4-40 x 1/4 round head machine screws with No. 5 lockwashers. Place hardware in safe place.

b. Before lifting assembly out of housing, note that the alignment plate (Figure 5-28) fits over a locator pin on the housing. Lift assembly out of housing. (There is a 1/4-inch ball bearing in bottom of attenuator housing; bearing may drop out when turret assembly is out of housing.)

c. Cartridges can be identified by referring to Figure 6-1. To remove cartridge of interest, remove retaining rings at each end; use a spreading tool such as a Truarc pliers to disengage retainers.

d. Slip new cartridge in place, and fasten with retaining rings removed in step c.

e. Return turret assembly to housing; with alignment plate fitted over locator pin, turret assembly will be correctly aligned.

5-204. INSTALLING ATTENUATOR ASSEMBLY.

a. Before reconnecting J1 Connector Body to Connector Shell W13MP4, be sure that Center Pin W13MP3, Insulator W13MP2 and Center Conductor W13MP1 are gently seated in connector body. Insert connector body in connector shell and rotate entire attenuator assembly, Cable W13 and connector body until connector body is firmly seated in connector shell. Install Coax Switch A22K1 on attenuator assembly and solder conductor removed in Paragraph 202e.

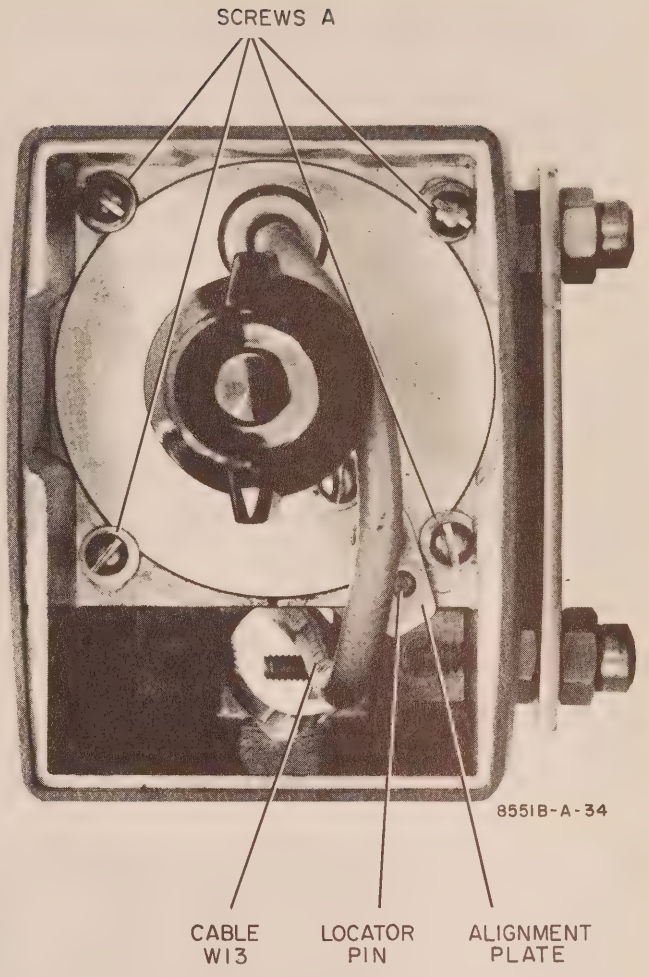


Figure 5-28. Input Attenuator Assembly A1, Front View (knob replaced on shaft)

b. Place attenuator assembly in instrument, orientating attenuator as noted in Paragraph 5-202a: bracket is toward inside of instrument and solder terminals on Coax Switch A22K1 toward top of instrument.

c. Slip shaft with lockwashers noted in Paragraph 202d, into panel and fasten in place with bushing removed in Paragraph 202d; tighten with a 1/2-inch wrench.

d. Find Cable W14 from Coax Mixer A3 (Figure 7-3), and connect to J37 (Figure 7-13) on Coax Switch A22K1. Connect Cable W15 from Mixer/Coupler A2 (Figure 7-2) to J38 on Coax Switch A22K1.

e. Connect black-white-yellow conductor from terminal on coaxial switch to clip connection on Connector A18B2.

f. Place knob on attenuator assembly shaft, and tighten setscrew just enough to hold knob on shaft. Turn knob clockwise to the stop. This is the 0-dB position. Loosen setscrew, position knob so white arrow points to 0, and fasten knob to shaft with the two setscrews.

5-205. Replacement of Tune Control Potentiometers.

5-206. VARIABLE RESISTORS R5, R6, AND R7. Resistor R5, the main tuning potentiometer, requires special tools and a detailed knowledge of the clutch and spring-loaded gearing arrangement for replacement. Should a failure occur in this potentiometer or drive assembly, it is recommended that the instrument be returned to the nearest Hewlett-Packard Service Center.

a. Resistor R6, the reference oscillator sweep centering potentiometer, is a wire-wound resistor that has a tendency to become noisy with use. When operating in the stabilized mode, noise in R6 can show up (as TUNE control is turned) as frequency instability or FM on the display CRT. Gears associated with TUNE are designed to facilitate replacement of R6. Replacement procedure for R6 is contained in Paragraph 5-207, steps a through u.

b. Resistor R7, the 2:1 potentiometer, when replaced, requires both mechanical and electrical alignment and a tracking adjustment. Replacement procedure for R7 is contained in Paragraph 5-207, steps v through z.

5-207. REPLACEMENT PROCEDURE.

a. Remove 8551 top cover, left side cover, and right side cover.

b. Remove trim from left side, and remove screws which fasten left side frame to front panel. Remove trim from right side, and remove screws which fasten right side frame to front panel. Referring to Figure 5-33, these are five screws C and five screws D.

c. Rest 8551 on left side, and take off bottom plate.

d. Refer to Figure 6-8, and note that Clutch Gears 77 and 82 are slotted, and that Clutch Collar 80 includes two setscrews (112) which bear on the shaft of R6 (75). To reach the setscrews which hold gears to R6 shaft, slots and setscrew access holes have to be aligned.

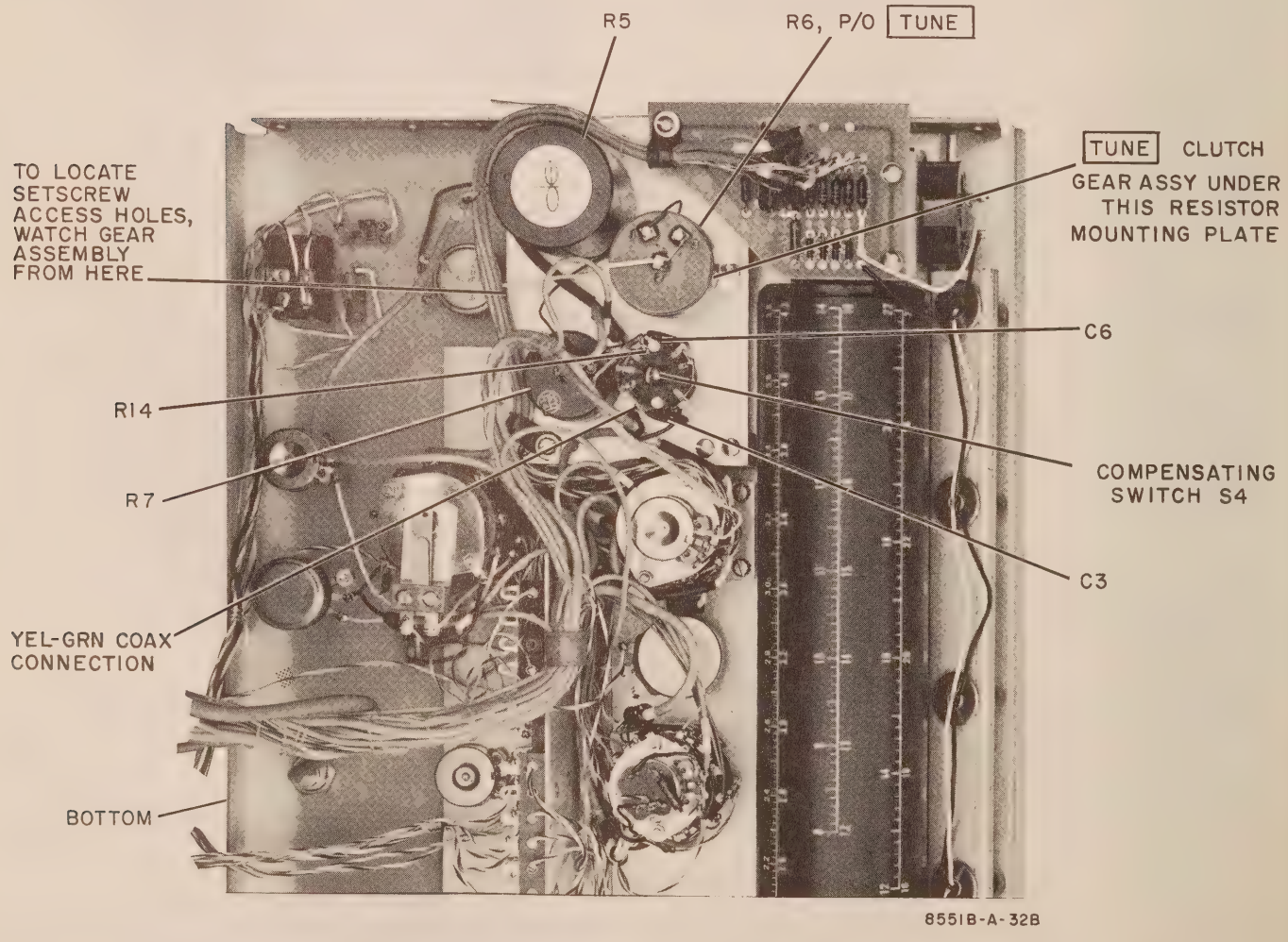


Figure 5-29. Portion of Rear of Front Panel, to Show Location of R6 and TUNE Clutch Gear Assembly, and Orientation of Gain-Compensating Switch S4

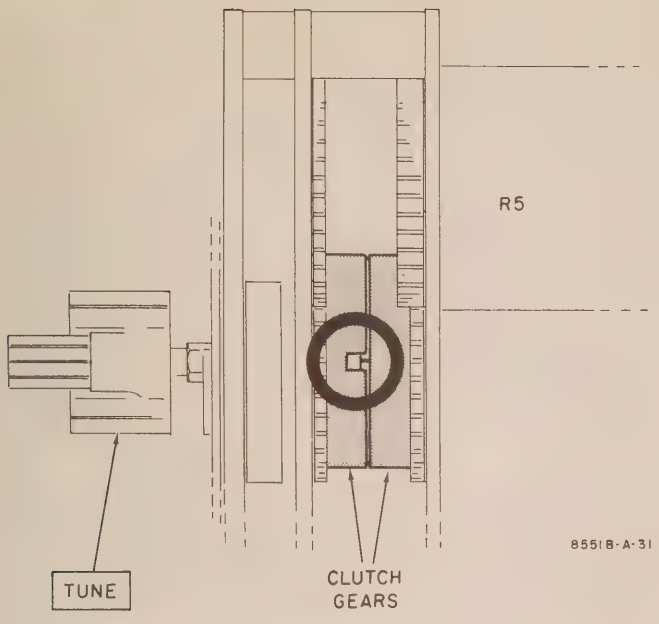


Figure 5-30. Setscrew-hole Locator in TUNE Clutch Gear Assembly

e. Replacement of R6:

(1) Locate Clutch Gears 77 and 82. They are located under the resistor mounting plate (see Figure 5-29), and can be seen when the gear assembly is viewed from the direction indicated in Figure 5-29. Location of clutch gears with respect to other gears seen looking in from bottom of instrument is indicated in Figure 5-30.

(2) Pull TUNE out to COARSE position, and turn TUNE until slot is visible.

(3) Push TUNE in to FINE position, and turn TUNE until setscrew-hole locator is visible. Setscrew-hole locator is shown in Figure 5-30; it is a narrow slot which can be seen through the larger slot.

(4) When setscrew-hole locator is found, pull TUNE out to COARSE again. The first setscrew access hole is now exposed.

f. Using a No. 6 Allen wrench, loosen setscrew.

g. Push TUNE in to FINE and turn to find second setscrew-hole locator. Pull TUNE out ot COARSE, and loosen second setscrew. Leave TUNE pulled out to COARSE.

h. Using No. 8 Allen wrench to loosen setscrews (2), remove TUNE knob. TUNE knob is secured with cup-point setscrews, and shaft will be scored; file shaft smooth or shaft cannot be pulled out of panel and gear bearings.

i. Free front panel (see Paragraph 5-229), and drop it to about 45 degrees.

j. Locate R6 (see Figure 5-29), and disconnect red lead from R6 Terminal 1 and white lead from Terminal 3.

k. Before removing R6, be sure front panel is dropped sufficiently to permit withdrawal of R6 shaft. Pull R6 straight back and out of panel.

m. Bracket on R6 shaft is held by a 3/8-32 nut and two 3/8 (No. 10) lockwashers. Remove bracket.

p. Insert shaft of new R6 through clutch bearings and front panel.

q. With a No. 6 Allen wrench, tighten setscrew loosened in step g.

Note

Though the setscrew should be tight to the shaft, be careful not to strip the screw.

r. Return TUNE knob to shaft and, using No. 8 Allen wrench, tighten setscrews (2).

s. Push TUNE in to FINE, and turn to find other setscrew-hole locator. When found, pull TUNE out to COARSE, and tighten setscrew loosened in step e.

t. On rear of R6, resolder leads disconnected in step j: red lead to Terminal 1, white lead to Terminal 3. Strap R6 Terminal 2 to 3 with 22-gauge solid copper conductor.

u. Reconnect front panel to chassis. See Paragraph 5-229, and follow directions in reverse.

v. Replacement of R7.

w. Removal Procedure:

(1) Perform steps a, b, and c above.

(2) Free front panel (see Paragraph 5-229), and drop it about 45 degrees.

(3) Locate R7 (see Figure 5-29), and unsolder the yellow-red coded wire from Terminal S, the black wire from Terminal CCW, and the white wire from Terminal CW.

(4) Loosen the 2 setscrews in the R7 shaft coupler.

(5) Remove nut and lockwasher securing R7 to mounting bracket.

x. Installation and Mechanical Alignment Procedure:

(1) Install new potentiometer and secure with hardware removed from old potentiometer.

(2) On rear of R7, solder leads disconnected in step w(3): yellow-red wire to Terminal S, black wire to Terminal CCW, and white wire to Terminal CW. Strap R7 Terminal S to Terminal CCW with 22-gauge solid copper conductor.

(3) Set TUNE control to low frequency stop (2-Gc on LOCAL OSC FREQ dial).

(4) With an ohmmeter, measure resistance between CW and CCW terminals on R7.

(5) Adjust potentiometer shaft for a resistance indication of 200 to 400 ohms.

(6) Mesh the two shaft couplers and tighten the setscrews in the coupler on R7 shaft.

(7) Check resistance as TUNE control is rotated to high frequency stop (4-Gc on LOCAL OSC FREQ dial). Resistance must increase smoothly to approximately 20K ohms.

(8) If resistance changes back to a low resistance at or near the high frequency stop, the potentiometer shaft must be reset at the low frequency stop.

(9) Repeat steps 7 and 8 as necessary.

y. Install chassis front panel. See Paragraph 5-229, and follow directions in reverse order.

z. Electrical Alignment Procedure:

(1) Set 8551 LINE switch to ON and allow at least one-half hour warm-up before making adjustments.

(2) Perform phase-lock tracking adjustments, Paragraph 5-96, steps i through s.

5-208. Replacing Gain-Compensating Switch S4.

5-209. EQUIPMENT REQUIRED.

a. Ohmmeter or milliammeter, item 5 or 28 in Table 5-1.

b. Long-nose pliers

c. No. 6 Allen wrench

d. 1/2-inch open-end wrench.

5-210. REMOVAL.

a. Free front panel (see Paragraph 5-229). Lay the panel back as far as possible without putting a strain on the cabling, and place a support under the opened panel.

b. Location of Gain-Compensating Switch S4 on rear of front panel is shown in Figure 5-29. Note orientation of switch: strapped contacts face toward frequency scale drum, and switch resistors face toward Resistor R7.

c. As used in the following, "top" and "bottom" refer to the switch as seen from the rear of the front panel. Thus "top wafer" is the wafer exposed when the panel is swung down, and "bottom wafer" is the wafer nearest the front panel. From the top wafer, unsolder the black lead, and from the bottom wafer, unsolder the coaxial cable color-coded yellow-green. Note location of terminal to which yellow-green cable was connected.

d. Remove frequency scale drum (see Paragraph 5-231).

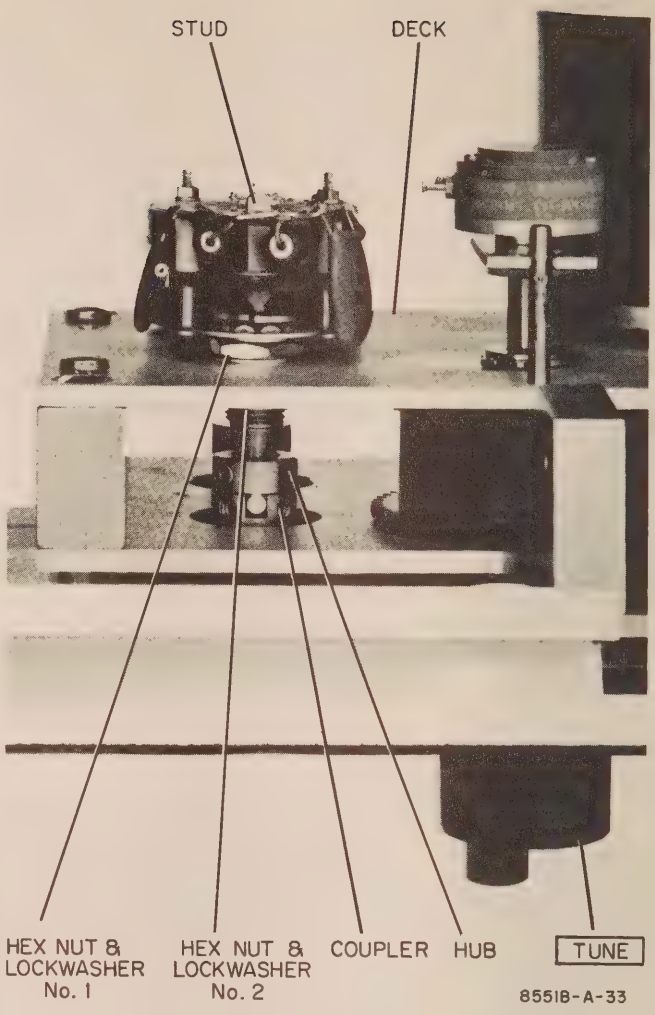


Figure 5-31. Portion of Rear of Front Panel, Frequency Scale Drum Removed to Show Mounting of Gain-Compensating Switch S4

e. Figure 5-31 shows Switch S4 in its mounting. Referring to Figure 5-31:

(1) Loosen Hex Nut No. 2 with 1/2-inch open-end wrench.

(2) The hub is secured to the switch shaft with two 6-32 x 1/8 Allen setscrews. With Hex Nut No. 2 loosened, Switch S4 can be rotated to expose each Allen screw; loosen the Allen screws.

(3) When removing Switch S4:

(a) Be careful not to disturb the position of the coupler.

(b) Be prepared to catch Lockwasher No. 2, Hex Nut No. 2, and the hub as switch shaft is lifted out of the deck.

(4) Transfer Hex Nut No. 1 and Lockwasher No. 1 from the old switch to replacement Switch S4.

2-211. INSTALLATION.

a. Holding switch so resistors are toward you and shaft is pointed away from you, rotate shaft so wiper engages the five contacts to which resistors are soldered.

b. Position switch so it will be oriented as observed in step b of Paragraph 5-210, and slip switch shaft into mounting hole in deck. Using long-nose pliers, place No. 2 Lockwasher and No. 2 Hex Nut on shaft, and then place hub on shaft.

c. Align hub and coupler, and push switch shaft firmly into coupler. Turn nut up onto shaft, and use wrench to tighten nut and lockwasher against deck.

5-212. ALIGNMENT.

a. Connect an ohmmeter from the terminal to which R14 is connected to the terminal to which the yellow-green cable will connect (both terminals are on the bottom wafer; see Figure 7-28 for identification of components). With wiper at position obtained in step a of Paragraph 5-211, ohmmeter is connected across the five contacts to which the resistors are connected.

b. Set TUNE for 2.42 on LOCAL OSC FREQ scale. Note hub; one Allen setscrew should be on face of hub; if not, turn hub (with soldering tool or other pointed instrument) so one of the Allen setscrews is on hub face.

c. Using a No. 6 Allen wrench, hold hub to coupler by applying pressure against setscrew on hub face. Now, note stud which protrudes through top wafer on switch: with long-nose pliers on the stud, move shaft back and forth while watching ohmmeter. Just as ohmmeter changes to 100KΩ, tighten the Allen setscrew.

d. Turn TUNE until other Allen setscrew is on face of hub; tighten the setscrew.

e. With the ohmmeter still connected across the switch, turn TUNE to 2 Gc on LOCAL OSC FREQ scale. Rotate TUNE slowly until ohmmeter reads 100KΩ again, and note pointer; it should be at 2.42.

f. Tune up band, past 2.42, then slowly turn TUNE back to 2.38; ohmmeter should read 0. (If ohmmeter doesn't read 0 at 2.32, loosen setscrews and repeat steps d through f. If reading 0 cannot be obtained at 2.38 when ohmmeter reads 100KΩ at 2.42, align switch so that 0 reading and the just-breaking-to-100KΩ reading are equidistant from 2.4.)

5-213. Replacing Diode A2CR1.

a. Rest 8551 on bottom plate, and remove top cover plate. Locate Mixer/Coupler Assembly A2 (Figure 7-2).

b. Disconnect Cable W7 (Figure 7-6) from J13 on Mixer/Coupler Assembly A2.

c. Diode A2CR1 is housed in a receptacle below J13. To remove J13 requires a 7/16-inch wrench with a socket that is at least 5/8-inch deep. Remove J13.

d. Using long-nose pliers, lift diode from assembly; note diode orientation -- large end (anode) is toward connector J13.

e. Insert replacement diode in assembly, cathode first. Replace Connector J13 and Cable W7.

f. Check:

(1) Sensitivity with FREQUENCY(GC) set to 1.8-4.2; see Paragraph 5-23. (With I.F. BANDWIDTH at 10KC, sensitivity should be at least -100 ohm.)

(2) Frequency Response with FREQUENCY(GC) set to 1.8-4.2; see Table 5-11 and Paragraph 5-30. (Response should be within ±3.5 dB across the band, within ±2.0 dB over any 100-Mc section of the band.

5-214. Sampler Assembly A23.

5-215. The sampler assembly is mounted on the side of Lock Assembly A15 (on the inside of the instrument). To reach the sampler, move Converter Assembly A9 out of the way as described in Paragraph 5-67, steps a and c.

5-216. SAMPLER INPUT. If sampler output voltage (measured in Paragraph 5-156) is low, first check the input to the sampler:

a. Disconnect Cable W10 from Connector J26 (see Figure 5-17) on Lock Assembly A15.

b. Using an RF voltmeter, such as the 411A, measure voltage at J26, 10-Mc oscillator/discriminator output.

(1) If 10-Mc output is not approximately 2 volts, check the 10-Mc oscillator/discriminator (see Paragraph 5-154).

(2) If 10-Mc output is approximately 2 volts, check sampler diodes.

5-217. SAMPLER DIODES. To check either diode, substitute a diode known to be good; part numbers for Diodes A23CR1 and A23CR2 are listed in Table 6-1. Unless otherwise specified, parts referred to in the following procedures are identified in Figure 5-32.

a. Preparation. It is easier to work on the sampler assembly if Lock Assembly A15 is lifted out of the instrument; see Paragraph 5-96a through h. To remove the sampler from the lock assembly:

(1) The sampler is fastened to the lock assembly with a 6-32 x 3/8 Allen screw, which takes a 3/32 Allen wrench. Remove screw B and associated hardward (No. 6 internal lockwasher and No. 6 flat washer).

(2) Disconnect Cable W10 from Sampler Connector J28, and Connector Assembly A23P1 from Lock Assembly Connector J29; see Figure 5-17.

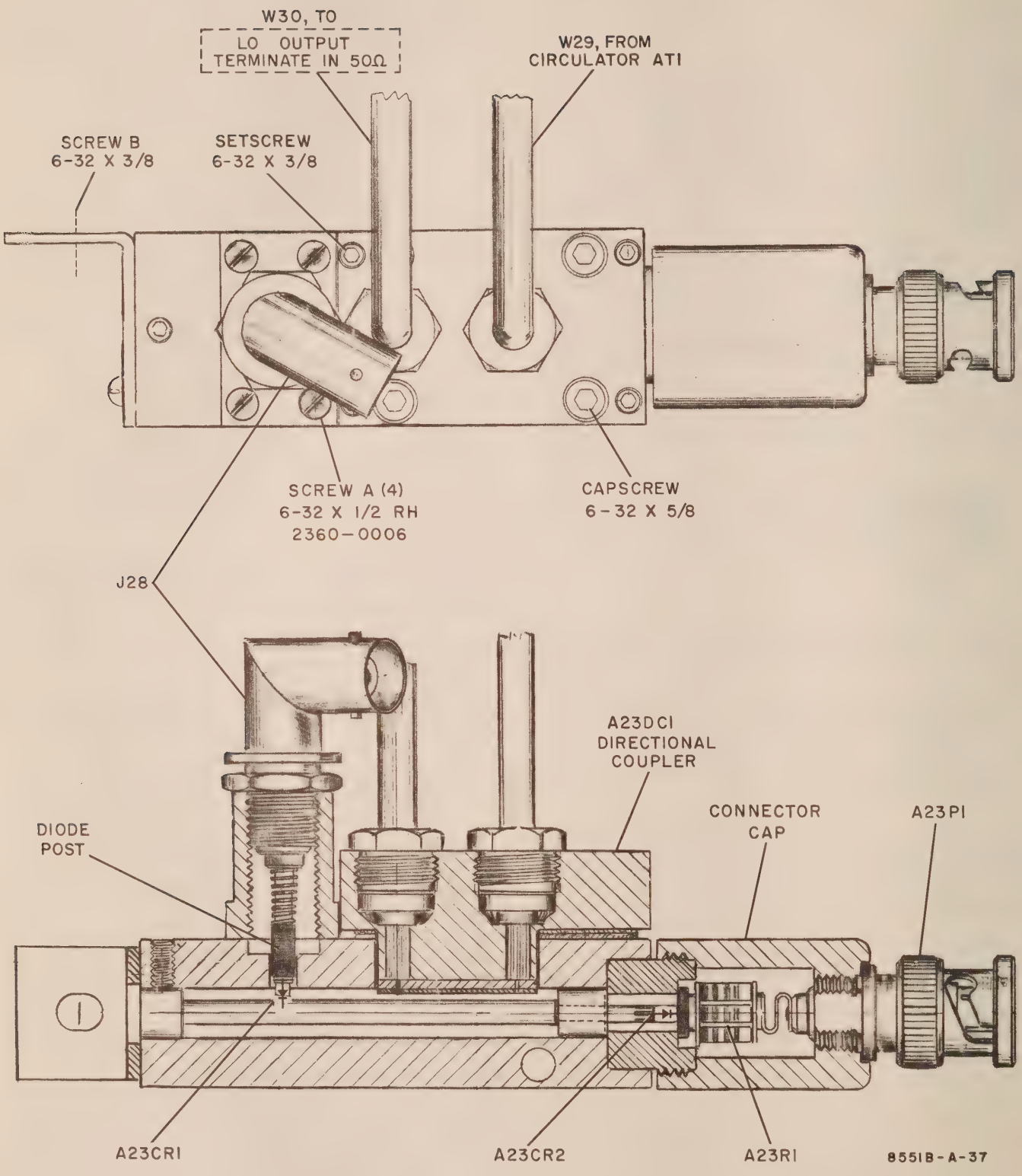


Figure 5-32. Sampler Assembly A23, Component Identification

b. Diode A23CR2.

CAUTION

This diode is extremely sensitive and can be damaged even by stray static charge. Never touch the diode with a device such as a voltmeter probe or pliers without first grounding the device to discharge it.

Diode A23CR2 is housed in a receptacle beneath Connector Assembly A23P1:

(1) To remove A23P1, screw off the connector cap.

(2) Before lifting A23CR2 out with long-nose pliers, touch the pliers to the chassis to discharge them. Then lift A23CR2 out, note diode orientation: the red color-coded electrode faces toward the connector. Install substitution diode.

(3) Reconnect Cable W10 to J28, and measure dc voltage output at A23P1; see Paragraph 5-96y, z. (Be sure to touch probe to ground to discharge any static before putting probe on connector pin.)

(4) If voltmeter reading of between 1.2 and 2.5 volts is obtained, reconnect A23P1 to J29, and check phase-lock hold-in range; see Paragraph 5-96at through az.

(5) If voltmeter reading of between 1.2 and 2.5 volts cannot be obtained, check Diode A23CR1.

c. Diode A23CR1. Diode A23CR1 is an extremely small, fragile, and expensive diode. It is held in place by a post which is accessible when connector J28 is removed. If the diode is dropped while taking it out, it could easily be lost or damaged. So be careful when removing Diode A23CR1. To remove:

(1) With the sampler free of the lock assembly, remove the four screws A (6-32 x 1/2) which hold Connector J28 to the sampler chassis. Note orientation of J28: the connector angle faces toward Directional Coupler DC1. Remove J28.

(2) Lift out post. If Diode A23CR1 does not lift out with the post, upend sampler, and carefully drop the diode into your hand. Note that the anode (coded end) faces toward the center of the sampler.

(3) When installing the substitution diode, be careful to position it so that it sits straight in the receptacle. Slip the diode post over the diode cathode.

(4) Fasten J28 in place, with the connector angle facing toward Directional Coupler DC1.

(5) Connect Cable W10 to J28, and measure dc voltage output at A23P1; see Paragraph 5-96y, z. Be sure to discharge any static before touching A23P1 pin with voltmeter probe.

(6) Check Analyzer hold-in range; see Paragraph 5-96at through az.

5-218. Replacing Diode A6CR1.

5-219. Diode A6CR1 should be replaced only after all other possible causes of loss of sensitivity have been checked: see Table 5-21, SENSITIVITY. If trouble is localized to the harmonic generator/2 Gc mixer, perform the troubleshooting procedure given in Table 5-30 before replacing Diode A6CR1.

5-220. Harmonic Generator A6 is located in the top part of the 8551 (see Figure 7-6), and is mounted on a plate with 2 Gc Mixer A7. Arrangement of Harmonic Generator A6 is shown in Figure 6-6. To remove A6CR1:

a. First remove Harmonic Generator A6 (and 2 Gc Mixer A7) from the instrument:

(1) Remove Converter Assembly A9 (see Paragraph 5-67a and c) and Lock Assembly A15 (see Paragraph 5-96a through h).

(2) Disconnect:

(a) Cable W23 from J25 on Converter A9; see Figure 5-6.
(b) Cable W4 from J20 on 2 Gc Mixer Assembly A7: see Figure 7-6.
(c) Cable W3 from J18 on Mixer A7: see Figure 7-6.

(3) Three 8-32 x 5/8 roundhead screws (with No. 8 internal-tooth lockwashers) hold generator-mixer mounting plate to deck. Remove plate and assemblies as a unit.

b. With a 9/64 Allen wrench, remove the six cap screws which secure cover plate to harmonic generator assembly.

c. Diode A6CR1 is connected between two posts on the under side of the cover plate. Note that the polarity mark on the diode is toward the inside post, and that the diode is mounted above the cover plate. Height of the diode above the cover plate is critical; it should be exactly 1/8 inch.

d. Diode A6CR1 is affected by heat, and therefore it is good practice to apply the soldering iron to the post rather than to the diode lead; make the application of heat as brief as possible. A 47.5-watt iron and small tip are recommended. Diode center-line should be exactly 1/8 inch from the face of the cover plate.

e. Replace cover plate on cavity, and tighten screws. Reconnect cables disconnected in step a(2). Using the procedure given in Paragraph 5-83b through h, adjust A6 FREQ ADJ.

f. To check diode performance, make the following measurements:

(1) Measure power out of Converter A9 at J25; see Figure 5-6 and Paragraph 5-73. Adjust for an output of at least +18 dBm.

(2) Measure power output of Harmonic Generator A6 as described in Table 5-30, Step 2. (Cable W24 connects the harmonic generator to 2 Gc Mixer A7.) (With an input of +18 dBm, power out of Harmonic Generator A6 should be at least 1.5 mW; with an input of +20 dBm, power out of A6 should be at least 2 mW.

5-221. Replacing Diode A7CR1.

5-222. Like Diode A6CR1, A7CR1 should be replaced only after checking all other possible causes for loss of sensitivity (Table 5-21), and performing the trouble-shooting procedures given in Table 5-30. Arrangement of 2 Gc Mixer Assembly A7 is shown in Figure 6-7. Diode A7CR1 is housed beneath Connector J20.

5-223. To replace Diode A7CR1:

a. Remove assembly from instrument; see Paragraph 5-220a.

b. Unscrew Connector J20; a mating male BNC connector may be used as a wrench.

c. In most mixer assemblies, Diode A7CR1 can be removed with a long-nose pliers. Note orientation: cathode faces toward inside of assembly.

d. Note coding on replacement diode, and insert diode, cathode first, in assembly. Screw on Connector J20, and reconnect cables disconnected in Paragraph 5-220a(2). Using the procedure given in Paragraph 5-92, adjust A7 FREQ ADJ.

e. To check diode performance, make the following tests:

(1) Sensitivity, 2GC IF, with FREQUENCY(GC) at .01-2: Paragraph 5-23.

(2) Frequency Response with FREQUENCY(GC) at .01-2: Paragraph 5-30 and Table 5-11.

5-224. GENERAL REPLACEMENT INFORMATION.

5-225. INPUT CONNECTOR J1. If it should be necessary to repair the connector at the front-panel coaxial INPUT, do not try to remove the pin from the center conductor with a soldering iron. The input pin screws onto the center conductor, it is not soldered on.

5-226. RESISTANCE OF R5. With TUNE at 2.0 GC on LOCAL OSC FREQ scale, resistance between terminals CW and S on resistor R5 (Figure 7-4) should be approximately 2500 ohms.

5-227. TRANSISTORS Q1-Q6. These transistors are mounted on a plate near LV Rectifier Assembly A18 near the bottom of the instrument; see Figures 7-3 and 7-37.

a. To work on transistors Q1-Q6, rest the 8551 on its right side, and remove bottom and left side plates.

b. Mounting hardware for Transistors Q1-Q4 is listed in Table 5-35.

CAUTION

When replacing Transistors Q1 and Q2, install the 4-40 x 1/2-inch machine screws as illustrated in Figure 7-37. Improper installation could result in contact between transistor mounting hardward and the slide-on connector pins to Connector A18A.

Table 5-35. Mounting Hardware, Transistors Q1-Q4

Transistor	Hardware (2 each, each Transistor)
Q1	4-40 x 1/2 mach screw w/int lockwasher
Q2	4-40 nut & No. 4 flat washer
Q3	No. 4 nylon washer
Q4	6-32 x 1/2 BH screw w/int lockwasher flat washer & nut w/int lockwasher

c. To loosen heat dissipator, housing transistor Q5 or Q6, use a 1/2-inch open-end wrench.

d. When replacing a transistor, be sure to use silicon grease (Dow Corning 5 Compound, HP stock number 8500-0059) between transistor and mounting plate to provide effective heat transfer.

5-228. TRANSISTOR A20Q1-A20Q6. Location of LV Series Regulator Assembly A20 is called out in Figure 7-2, and arrangement of the transistors is shown in Figures 7-42 and 7-43. When replacing a transistor, use silicon grease (Dow Corning 5 Compound, HP stock number 8500-0059) between transistor and mounting plate to provide effective heat transfer.

5-229. Freeing Front Panel.

5-230. Side panel detail and screws identified by letter are shown in Figure 5-33.

a. Remove top cover, left side cover, and right side cover; tools required: Phillips screwdriver and heavy-blade screwdriver.

b. Remove trim on left and right sides. Use tip of screwdriver (or other pointed tool) to loosen trim at top, and carefully pull trim off.

c. Remove the 8 (B) screws securing the four brackets and center H-section to the right side frame. Do not remove the screws securing the center H-section to the four brackets or chassis. B screws are 8-32 x 3/8

d. Remove the remaining B screws securing the right side frame to chassis and helix mounting assembly. It is not necessary to remove the three B screws securing the circulator mounting bracket to the right side frame.

e. Remove the 5 (D) screws securing the right side frame to the front panel. Screws D are 8-32 x 1/2.

CAUTION

When front panel is freed (step g) from side frames, there is nothing to hold it except cabling. It is important there be no strain on cabling; support panel so it cannot open farther than 35 to 45 degrees.

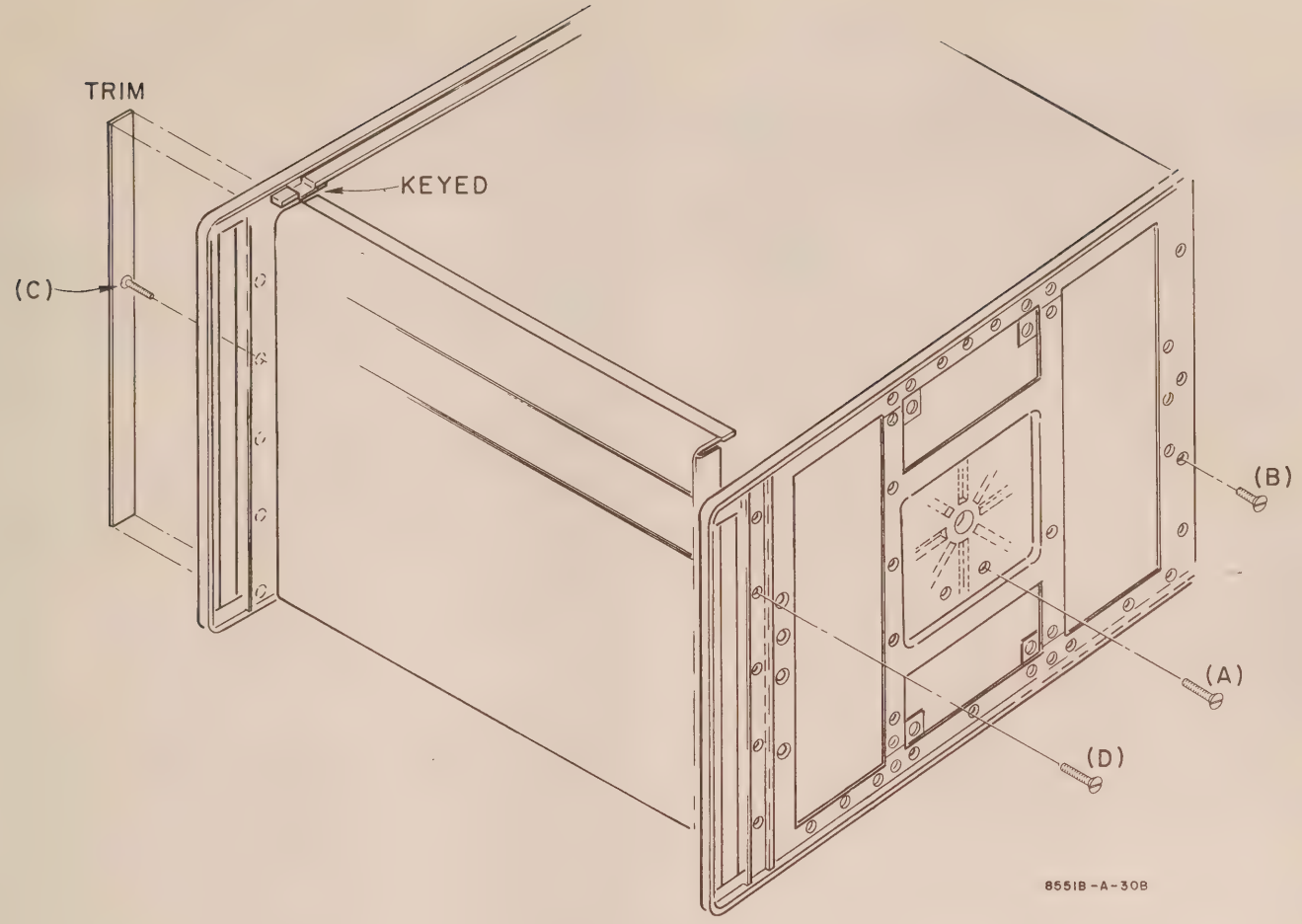


Figure 5-33. Side Panel Detail, Model 8551

f. On left side, remove five screws C. Note that one of C screws is 8-32 x 1/2" while others are 8-32 x 3/8".

g. Panel is keyed to side frame on each side, and fit is tight. Suggested procedure for freeing panel from side frames:

(1) Disengage right side frame and front panel. Vigorous push against front handle on right side frame is effective.

(2) Free panel from right-side keying with backwards-and-forwards motion until there is sufficient space to insert blade of screwdriver between side frame and panel. Then pry panel and side frame apart being careful to keep panel from falling far enough to put strain on cabling.

5-231. Removing Frequency Scale Drum.

5-232. HARDWARE. Screws removed or loosened in the following procedure are identified in Figure 5-34 or Figure 6-8, and described as follows:

a. Screw A, 6-32 x 1-1/4 RH w/split washer, flat washer (Figure 5-34).

b. Screw B, 6-32 x 5/16 BH with lockwasher, HP stock number 2390-0007, Index No. 38.

c. Screw C, 1/4-28 x 1-1/2, HP stock number 08551-2296, Index No. 63.

d. Nut, 1/4-28 x 3/8, HP stock number 2590-0036, Index No. 64.

e. Dial spring, HP stock number 1460-0196, Index No. 18.

5-233. PROCEDURE. The frequency scale drum is held in place by a large spring at one end (item 18, Figure 6-8) and a long screw at the other. This long screw (Screw C, Figure 5-34) is accessible when Meter Board Assembly A21 is removed from the drum support block.

a. Remove Screws A and B (see Figure 5-34), and swing Meter Board Assembly A21 and Meter M1 out; move them as one assembly, do not touch Screws D.

b. Using a 3/8-inch open-end wrench, loosen the nut which secures Screw C. Then, holding frequency scale drum with one hand, free drum by turning Screw C until end of screw is flush with mounting block.

c. Lift near end of drum up, and carefully disengage far end so spring will not fly out.

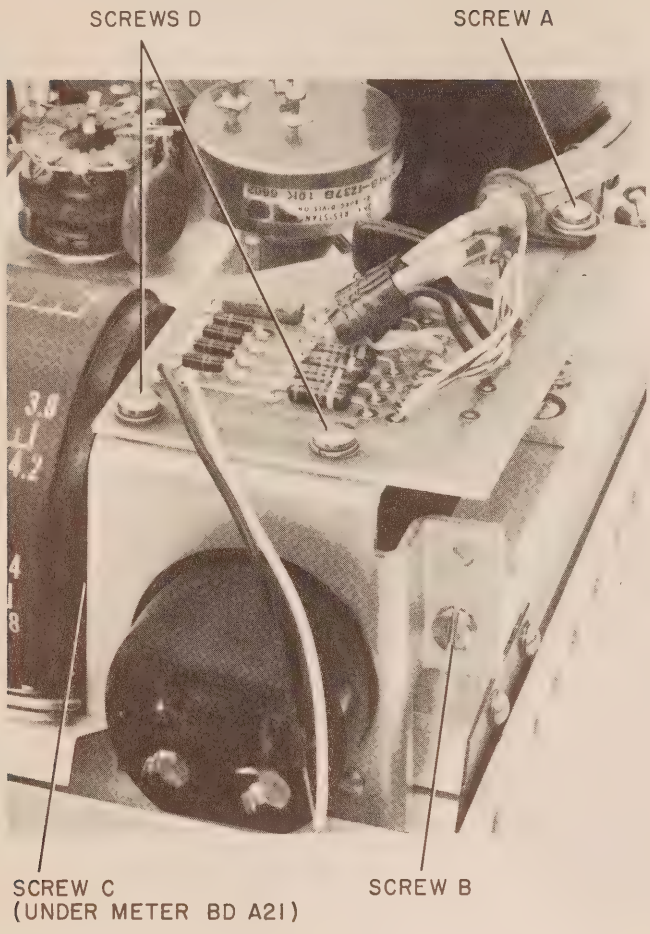


Figure 5-34. Portion of Rear of Front Panel, as Viewed from Top of Panel

d. With drum out of its mounting, either stand it where it cannot be knocked down or wrap it carefully in a soft covering, such as type 301 Kimpak. The dial window must be protected to prevent breakage.

5-234. Alignment of Frequency Scale Drum.

Note

Right-end bearing and frequency scale drum can be completely removed to allow access to the switch wiring on the front panel assembly; see Paragraph 5-231.

5-235. The frequency scale drum can be shifted to correct mechanical misalignment between the LOCAL OSC FREQ scale and the frequency scales on the drum. The left-end bearing of the drum is spring-loaded. The right-end bearing is threaded through the casting and held in place by a lock nut. To align the scales:

a. Free the front panel; see Paragraph 5-229.

b. To expose the right-end bearing and lock nut, remove Screws A and B (Figure 5-34) which hold Meter Board Assembly A21 in place; if there are spacer washers, be sure to remove them from the instrument with the screws. Lift the A21 board out of the way.

c. Loosen lock nut, and thread bearing in or out until dials are aligned. Tighten lock nut.

d. Before replacing meter board assembly, check alignment at various settings of FREQUENCY(GC); a good reference point is 3 GC on the LOCAL OSC FREQ scale. If necessary, align for best compromise.

5-236. Removing Switches.

5-237. Larger knobs are secured to the shaft with an 8-32 x 3/16 setscrew which is loosened with a No. 8 Allen wrench. The red verniers are secured to the shaft with a 6-32 x 1/8 setscrew; loosen with a No. 6 Allen wrench.

5-238. Tune Control Brake Adjustment.

5-239. The TUNE control brake mechanically locks the BWO main tuning potentiometer R5 and the 2:1 potentiometer R7 when STABILIZATION switch is in OSC TRACK position (see Paragraph 3-23). Adjustment of the mechanical brake is required following replacement of STABILIZATION switch or BWO main tuning potentiometer or associated drive system. Adjustment should be performed when there is excessive brake drag in the STABILIZED position of STABILIZATION switch or when the brake does not hold in OSC TRACK position.

a. Faulty brake adjustment is indicated by:

(1) Excessive loss of stabilization (analyzer has to be stabilized more than one time per frequency band); caused by brake drag.

(2) Loss of display signal on CRT as TUNE control is rotated and movement of frequency pointer (analyzer in OSC TRACK mode); indicates brake slippage.

b. A check of brake drag can be performed and condition verified by checking the number of turns of the TUNE control (FINE tuning) required to move frequency pointer from 2.0 to 4.0 Gc on LOCAL OSC FREQ scale. To check; set STABILIZATION switch to STABILIZED, TUNE control to FINE. Rotate TUNE control and count the number of turns required to move frequency pointer from 2.0 to 4.0 Gc. Correct adjustment of brake drag is indicated by a rotation of 200±1 turns of TUNE control.

c. To check brake slippage perform stabilization procedure contained in Figure 3-5. Rotate STABILIZATION switch to OSC TRACK position. Turn TUNE control (FINE TUNE only) while watching for movement of frequency pointer and signal displayed on CRT. There should be no visual movement of pointer on display.

d. Brake system components are illustrated in Figure 6-8 and called out by Index Number. The brake level (99) is pulled against potentiometer shaft (92) by spring (94) and brake cable (53) when brake collar (50) is rotated in a clockwise direction. Adjustment of the brake system is accomplished by positioning the brake collar on the STABILIZATION switch shaft.

e. To adjust brake:

(1) Set LINE switch to OFF.

(2) Set STABILIZATION switch to STABILIZED.

(3) Remove knobs from PRE STAB BAL control and STABILIZATION switch.

(4) Note orientation of brake collar set screws.

(5) Loosen set screws and rotate brake collar clockwise to correct for brake slippage. Rotate counterclockwise to correct for brake drag.

(6) Rotate brake collar a few degrees and tighten set screws.

(7) Replace STABILIZATION switch knob and check brake for correct adjustment (see b and c above).

(8) Repeat steps 5, 6, and 7, if necessary, for correct adjustment.

(9) Replace PRE STAB BAL knob. Check for correct orientation of directional arrow.

5-240. Etched Circuits.

5-241. The etched circuit boards in the 8551 Spectrum Analyzer RF Section are of the plated-through type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended through the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results. Table 5-36 lists recommended tools and materials. Following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and/or adjacent components.

Table 5-36. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering Iron	Soldering Unsoldering	* Wattage rating: 47-1/2 Tip Temp: 850 - 900°	Ungar #776 Handle with *Ungar #4037 Heating Unit
Soldering *Tip	Soldering Unsoldering	*Shape: pointed	*Ungar #PL111
De-soldering aid	To remove molten solder from connection	Suction device	Soldapullt by Edsyn Co. Arleta, California
Resin (flux) solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board material or conductor bonding agent	Alpha No. 563 Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead), 18 gauge (SWG) preferred	
Protective coating	Contamination, corrosion protection after soldering	Good electrical insulation, corrosion-prevention properties	Krylon (R) #1302** Humiseal Protective Coating, Type 1B12 by Columbia Technical Corp., Woodside 77, New York

*For working on 8551 Boards: for general purpose work, use Ungar #1237 Heating Unit (37.5W, tip temp of 750-800°) and Ungar #PL113 1/8" chisel tip.
**Krylon, Inc., Norristown, Pennsylvania

b. Do not use a high-wattage soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

c. Use a suction device (Table 5-36) or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion. See Table 5-36 for recommendations.

5-242. TRANSISTOR REPLACEMENT.

a. Do not apply excessive heat; see Table 5-36 for recommended soldering tools.

b. Use long-nose pliers between transistor and hot soldering iron as a heat sink. The instant solder is melted, use pliers to pull lead free of board.

c. When installing replacement transistor, leave enough lead length to dissipate soldering heat by using about the same length of exposed lead as used for original transistor. When replacing power transistors, always use silicon grease (Dow Corning 5 Compound, HP stock number 8500-0059) between transistor and mounting surface to provide effective heat transfer.

5-243. COMPONENT REPLACEMENT.

a. Remove defective component from board.

Note

Axial lead components, such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrapped connection, and clip off excess lead.

b. If component was unsoldered, remove solder from mounting holes with a suction desoldering aid (Table 5-36) or wooden toothpick.

c. Shape leads of replacement component to match mounting hole spacing.

d. Insert component leads into mounting holes, and position component as original was positioned. DO NOT FORCE LEADS INTO MOUNTING HOLES: sharp lead ends may damage plated-through conductor.

5-244. ETCHED CONDUCTOR REPAIR. A broken or burned section of conductor can be repaired by bridging the damaged section with a length of tinned copper wire. Allow adequate overlap and remove any varnish from etched conductor before soldering wire into place.

Table 5-37. Adjustments Required Following Transistor Replacement

Transistor	Adjustment	Paragraph Reference
A14Q1, 1854-0003	PRE STAB BAL A24R1 and OSC GAIN ADJ A14R22	5-95 aj-am
A14Q2, 1854-0005 2N708	PRE STAB BAL A24R1 and OSC GAIN ADJ A14R22	5-95 aj-am
A14Q3, 1854-0005 2N708	PRE STAB BAL A24R1 and OSC GAIN ADJ A14R22	5-95 aj-am
A16Q1, 1855-0001	Check time delay from STANDBY to ON; should be approximately 90 seconds. Select A16R4 for correct time delay.	
A19Q1 - A19Q9	Check -200-V, +150-V, and +300-V supplies for a) voltage b) regulation c) ripple	5-55 a, b
A20Q1 - A20Q6	Check -200-V, +150-V, and +300-V supplies for a) voltage b) regulation c) ripple	5-55 a, b
Q1 - Q4	Check -6.3-V supply for a) voltage b) regulation c) ripple	5-55 c
Q5 - Q6	Check -6.3-V supply for a) voltage b) regulation c) ripple	5-55 c

Table 5-38. Adjustments Required Following Tube Replacement

Tube	Function	Adjustment	Paragraph Reference
A5V1	2GC IF Amplifier	2GC tuning	5-91
A9A1V1	200MC IF Amplifier	200MC IF tuning	5-77
A9A2V1	200-20MC Mixer	Mixer tuning	5-77
A9A3V1 A9A4V1	180MC Oscillator 180MC Amplifier	A9A3C7, A9A4C3, A9A4C7, A9A4R2	5-68 5-74
A13V1	Coarse balance differential amplifier	SPECTRUM CENTERING adjust	3-31
A13V2	A: Helix supply cathode follower	None required	
	B: 10MC Osc/Disc. cathode follower	None required	
A13V3/V4	Helix voltage regulator tubes	Check BWO frequency calibration	5-58
A13V5	10MC Differentail Ampl	A13R19, DIFF AMPL BAL ADJ A14R9, 2:1 ADJ	5-95t, u, v 5-95i-s
A13V6	Helix Amplifier	Check BWO frequency calibration	5-58
A13V7	Cathode Followers	Check BWO frequency calibration	5-58
A13V8	Helix Amplifier	Check BWO frequency calibration	5-58
A13V9	Discharge tube	None required	
A14V1	Ramp Amplifier	A14R4, RAMP ADJ A14R6, DC BAL ADJ	5-95i-s 5-95i-s
A15A1V1 A15A1V2	10MC Oscillator Discriminator Driver	A13R19 DIFF AMPL BAL ADJ A15A1C2 10MC OSC FREQ ADJ A15A1C21 DISC SECONDARY ADJ A14R9 2:1 ADJ	5-95t, u, v 5-95w-ai 5-95w-ai 5-95ba-bg
V1, 2	Helix Series Regulators	Check BWO frequency calibration	5-58
V4	Collector voltage-regulator tube	Check BWO frequency calibration	5-58
V5	BWO	A16R8 ANODE ADJ Check BWO frequency calibration	5-57 5-58
V6	Anode cathode follower	A16R8 ANODE ADJ	5-57

Table 5-39. Table of Factory-Selected Components

Reference Designation	Basis of Selection	Schematic Diagram
A5R1	To limit A5V1 plate current to 18 mA	7-15
A9A4C11	Selected to match impedance between 180-Mc oscillator and the 180-Mc buffer amplifier	7-18
A10R1	Best compromise, all ranges	7-18
A10R2	*Shift of 181.80 kc in 180-Mc Osc freq	7-18
A10R3	*Shift of 163.62 kc in 180-Mc Osc freq	7-18
A10R4	*Shift of 145.44 kc in 180-Mc Osc freq	7-18
A10R5	*Shift of 127.26 kc in 180-Mc Osc freq	7-18
A10R6	*Shift of 109.08 kc in 180-Mc Osc freq	7-18
A10R7	*Shift of 90.90 kc in 180-Mc Osc freq	7-18
A10R8	*Shift of 72.72 kc in 180-Mc Osc freq	7-18
A10R9	*Shift of 54.54 kc in 180-Mc Osc freq	7-18
A10R10	*Shift of 36.36 kc in 180-Mc Osc freq	7-18
A10R11	*Shift of 18.18 kc in 180-Mc Osc freq	7-18
A10R12	Best compromise, all ranges	7-18
A14R4, A14R19	Adjusts range of OSC GAIN ADJ A14R22. Set STABILIZATION to STABILIZED, and LINE to STANDBY. Select A14R19 for 0.5 to 0.8 V peak-to-peak (7.0-cps) at A13V4, pin 2. Set A14R22 so search oscillator just oscillates	7-29
A15A1C10	With A15A1C9 adjusted for approximately 2 V rms** at J26 and noise sidebands within specifications (see Par. 5-96bs-bu), select A15A1C10 for 2.2-3.0 V rms** at Disc. Input TP1.	
A15A1R1, A15A1R14	Same as A15A1C10	
A15A4R2, A15A4R18	Selected in conjunction with A15A4Q1 or Q2 to provide required pulse amplifier gain. Value is correct when, with a -35-dBm, 10-Mc signal amplitude-modulated 20% at 1000 cps in at J29, output at pulse amplifier output A15TP2 is a 400-mV peak-to-peak, 1000-cycle signal.	7-29
A16R3	For BWO collector voltage of 110 V ±15 V with respect to helix.	7-35
A16R9	To adjust range of BWO ANODE ADJ A16R8 to obtain anode voltage marked on BWO; see Par. 5-57.	7-38
A17C2	For best compromise between phase-lock noise (see Par. 5-96bo-bu) and retrace time on fastest sweeps.	
A17R1, A17R4, A17R7, A17R10, A17R13, A17R16, A17R19, A17R22, A17R25, A17R29	To adjust range of calibrate potentiometers (see Table 5-3). If calibration cannot be obtained with any given potentiometer and (1) BWO frequency is low at a calibrate frequency, lower the fixed resistance in series with the pot. (2) BWO frequency is high at a calibrate frequency, increase the fixed resistance in series with the pot.	7-35
A19R16	Relay A19K1 operation at 4.2 to 4.6 V (as measured across A19R16)	7-41
A19R32	Relay A19K2 operation at 4.2 to 4.6 V (as measured across A19R32)	7-41
R46	With TUNE at 4.0 Gc, and SPECTRUM WIDTH VERNIER max ccw (no sweep), Relay K4 operates when helix current exceeds 4.0 mA maximum.	7-35

*Shift of 18.18 kc/step (2 cm/step on 851 CRT)

**As read on 411A RF Millivoltmeter

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. Tables 6-1, 6-2, and 6-3 list parts in the alpha-numeric order of their reference designations and give the Hewlett-Packard stock number and description for each part, together with any applicable notes. Miscellaneous parts not assigned a reference designation are listed at the end of the table that covers the assembly with which the part is associated. Reference Designation Index Tables cover the following assemblies:

Table 6-1. Assemblies A1-A8, A10-A14, A16-A25 and parts mounted on the chassis.

Table 6-2. Converter Assembly A9.

Table 6-3. Lock Assembly A15.

6-3. Table 6-4 lists parts in the alpha-numeric order of their HP stock numbers, and provides the following information on each part: 1) description of part (see list of abbreviations below), 2) typical manufacturer of part in five-digit code (see code list of manufacturers in Table 6-5), 3) manufacturer's stock number, 4) total quantity used in instrument (TQ column).

6-4. ORDERING INFORMATION.

6-5. To order a replacement part, address order or inquiry to your nearest Hewlett-Packard Sales and Service Office. Addresses of these offices around the world are given at the rear of this manual.

6-6. Specify the following for each part: 1) model and complete serial number of instrument, 2) Hewlett-Packard stock number, 3) reference designations, and 4) description.

6-7. When ordering from Hewlett-Packard always furnish the HP stock number. The part you receive may not be made by the manufacturer listed but will be electrically and mechanically interchangeable, and performance will be equal. Manufacturer's part number is listed for your convenience should you want to order directly.

6-8. To order a part not listed, give complete description of the part and include its function and location.

REFERENCE DESIGNATORS

A = assembly	F = fuse	MP = mechanical part	V = vacuum, tube, neon bulb, photocell, etc.
B = motor	FL = filter	P = plug	
BT = battery	IC = integrated circuit	Q = transistor	VR = voltage regulator
C = capacitor	J = jack	R = resistor	W = cable
CP = coupler	K = relay	RT = thermistor	X = socket
CR = diode	L = inductor	S = switch	Y = crystal
DL = delay line	LS = loud speaker	T = transformer	Z = tuned cavity, network
DS = device signaling (lamp)	M = meter	TB = terminal board	
E = misc electronic part	MK = microphone	TP = test point	

ABBREVIATIONS

A = amperes	H = henries	N/O = normally open	RMO = rack mount only
AFC = automatic frequency control	HDW = hardware	NPO = negative positive zero (zero temperature coefficient)	RMS = root-mean square
AMPL = amplifier	HEX = hexagonal		RWV = reverse working voltage
	HG = mercury		
BFO = beat frequency oscillator	HR = hour(s)	NPN = negative-positive-negative	S-B = slow-blow
BE CU = beryllium copper	HZ = hertz	NRFR = not recommended for field replacement	SCR = screw
BH = binder head	IF = intermediate freq		SE = selenium
BP = bandpass	IMPG = impregnated	NSR = not separately replaceable	SECT = section(s)
BRS = brass	INCD = incandescent		SEMICON = semiconductor
BWO = backward wave oscillator	INCL = include(s)		SI = silicon
	INS = insulation(ed)	OBD = order by description	SIL = silver
CCW = counter-clockwise	INT = internal	OH = oval head	SL = slide
CER = ceramic		OX = oxide	SPG = spring
CMO = cabinet mount only	K = kilo = 1000		SPL = special
COEF = coefficient		P = peak	SST = stainless steel
COM = common	LH = left hand	PC = printed circuit	SR = split ring
COMP = composition	LIN = linear taper	PF = picofarads = 10^{-12} farads	STL = steel
COMPL = complete	LK WASH = lock washer		TA = tantalum
CONN = connector	LOG = logarithmic taper	PH BRZ = phosphor bronze	TD = time delay
CP = cadmium plate	LPF = low pass filter	PHL = Phillips	TGL = toggle
CRT = cathode-ray tube		PIV = peak inverse voltage	THD = thread
CW = clockwise	M = milli = 10^{-3}	PNP = positive-negative-positive	TI = titanium
	MEG = meg = 10^{6}		TOL = tolerance
DEPC = deposited carbon	MET FLM = metal film	P/O = part of	TRIM = trimmer
DR = drive	MET OX = metallic oxide	POLY = polystyrene	TWT = traveling wave tube
	MFR = manufacturer	PORC = porcelain	
ELECT = electrolytic	MHZ = mega hertz	POS = position(s)	U = micro = 10^{-6}
ENCAP = encapsulated	MINAT = miniature	POT = potentiometer	
EXT = external	MOM = momentary	PP = peak-to-peak	VAR = variable
	MTG = mounting	PT = point	VDCW = dc working volts
F = farads	MY = "mylar"	PWV = peak working voltage	
FH = flat head			W/ = with
FIL H = fillister head	N = nano (10^{-9})	RECT = rectifier	W = watts
FXD = fixed	N/C = normally closed	RF = radio frequency	WIV = working inverse voltage
	NE = neon	RH = round head or right hand	
G = giga (10^{9})	NI PL = nickel plate		WW = wirewound
GE = germanium			W/O = without
GL = glass			
GRD = ground(ed)			

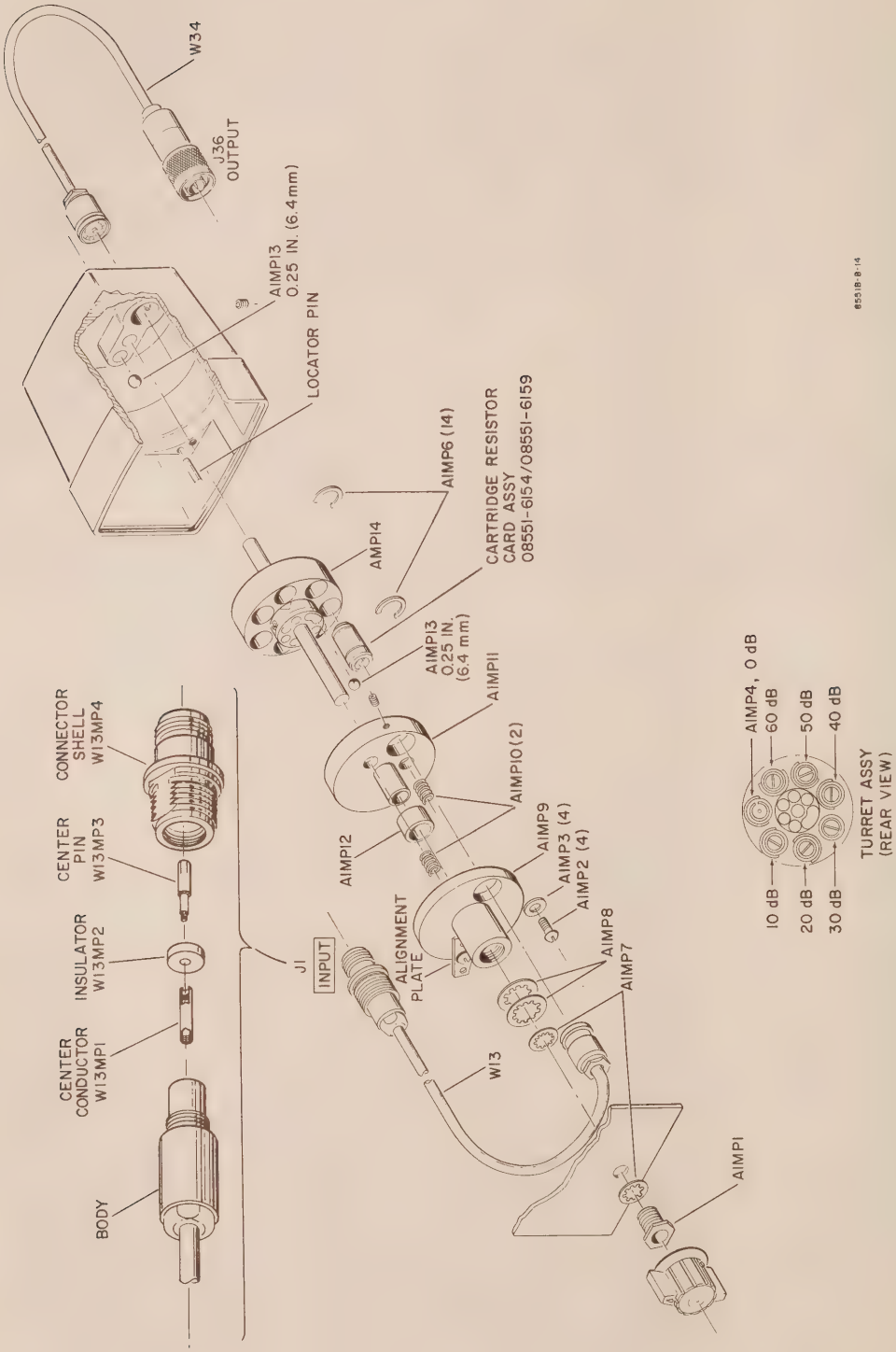


Figure 6-1. Input Attenuator Assembly A1, Component Identification

Table 6-1. Model 8551B Reference Designation Index, General

Reference Designation	Stock No.	Description #	Note
A1	08551-6148	INPUT ATTENUATOR ASSY FIG 6-1	
A1MP1	1410-0110	BUSHING:PANEL	
A1MP2	2200-0003	SCREW:SST RH 4-40 X 1/4	
A1MP3	3050-0116	WASHER:FLAT NO 5	
A1MP4	08551-6151	CARTRIDGE ASSY 0 DB	
A1MP5	08551-4005	TURRET:MAIN	
A1MP6	0510-0219	RING:RETAINING 7/16 INCH DIA	
A1R1	08551-6154	CARTRIDGE RESISTOR CARD ASSY 10DB	
A1R2	08551-6155	CARTRIDGE RESISTOR CARD ASSY 20DB	
A1R3	08551-6156	CARTRIDGE RESISTOR CARD ASSY 30DB	
A1R4	08551-6157	CARTRIDGE RESISTOR CARD ASSY 40DB	
A1R5	08551-6158	CARTRIDGE RESISTOR CARD ASSY 50DB	
A1R6	08551-6159	CARTRIDGE RESISTOR CARD ASSY 60DB	
A1S1	0370-0112	KNOB:ATTENUATOR (DB)	
A2	08551-6162	MIXER/COUPLER ASSY FIG 6-2	
A2CR1	08551-8025	DIODE:SILICON	
A2MP1	5000-0234	CONTACT:SPRING	
A2MP2	08551-2072	STRIP:MIXER/COUPLER	
A2MP3	08551-2073	BOARD:MIXER/COUPLER	
A2MP4	3030-0017	SCREW:CAP 8-32X1/2	
A2MP5		NOT ASSIGNED	
A2MP6	00774-209	RESISTOR CONE	
A2MP7	0510-0222	RING:RETAINING GRIP STL CADMIUM PLATED	
A2R1	0727-0022	R:FXD DEPC 50 OHM 1% 1/2W	
A3	08551-6167	COAX MIXER ASSY	
A3C1	08551-6169	CAPACITOR ASSY:1150 PF	
A3C2	08551-2318	C:FXD CER 1000 PF +80-20% 500VDW	
	1460-0113	SPRING:JUMPER(C2 TO C3)	
A3C3	0160-2357	C:FXD CER FEED THRU 1000 PF +80-20%	
A3CR1	1900-0016	DIODE:SILICON POINT CONTACT	
A3DC1	08551-6168	DIRECTIONAL COUPLER ASSY	
	2200-0010	SCREW:MACHINE RH SST 4-40 X 3/4	
A3E1	08551-2331	BEAD:POLYIRON	
A3MP1	08551-2316	CAP:DIODE HOLDER	
A3MP2	08551-2322	SPACER:CONNECTOR	
A3MP3	08551-2310	COVER:IF CAVITY	
	3030-0147	SCREW:SET 6-32 X 3/8 W/LOCK STRIP IF CAVITY ADJ	
A3MP4	08551-2319	HOLDER:DIODE	
A3MP5	08551-2311	BLOCK:FILTER	
	2200-0010	SCREW:MACHINE RH SST 4-40 X 7/8	

See list of abbreviations in introduction to this section

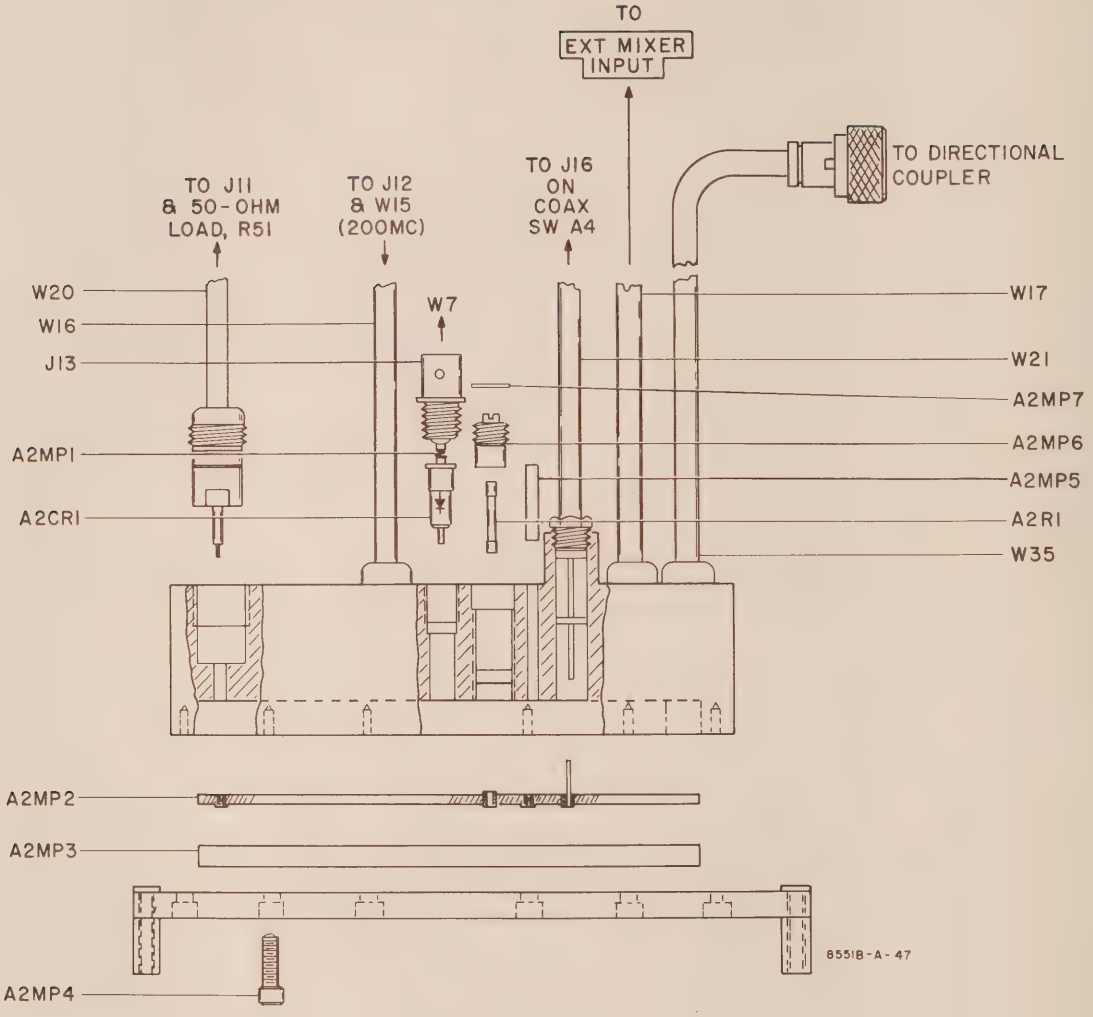


Figure 6-2. Mixer/Coupler Assembly A2, Component Identification

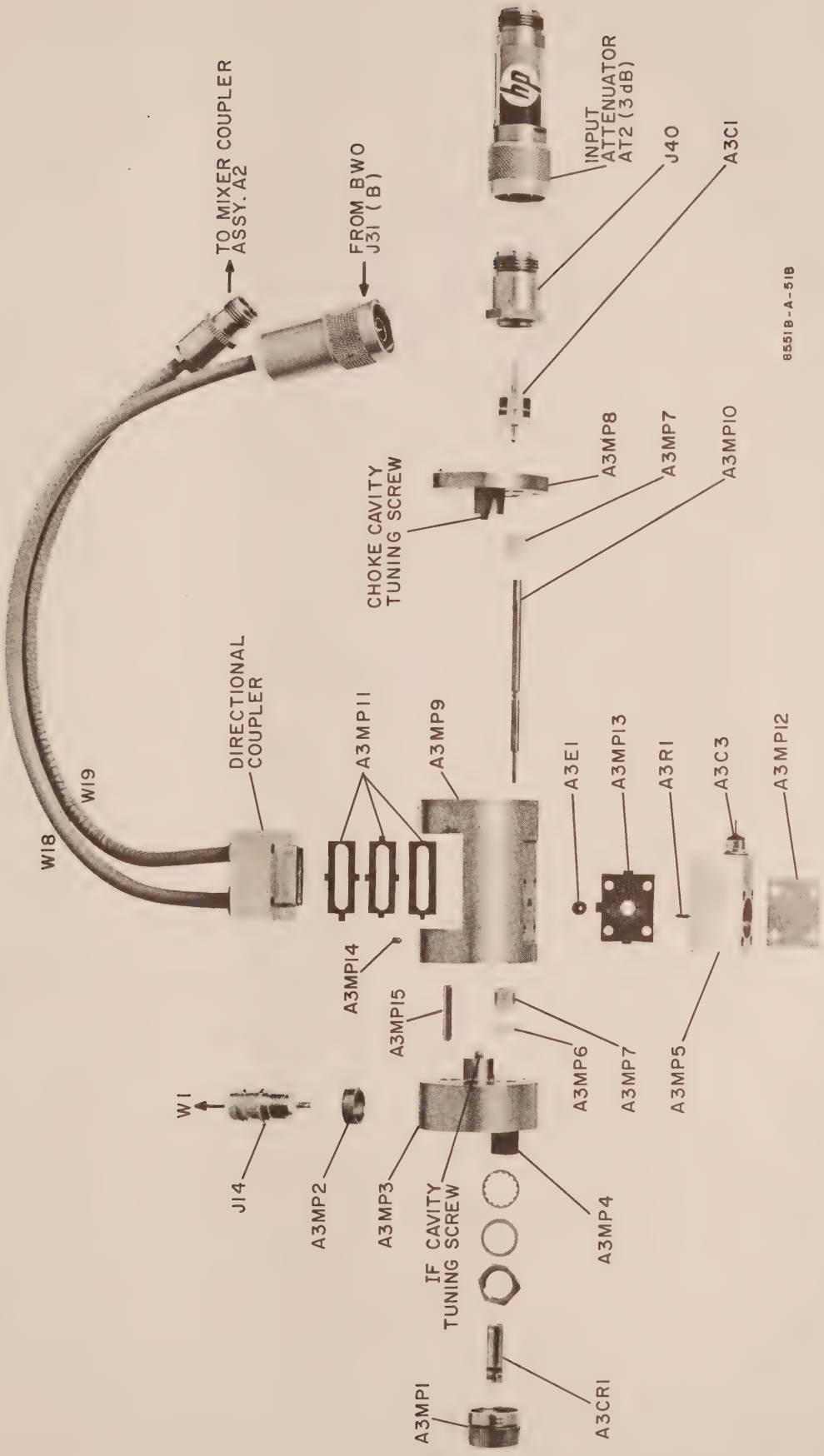


Figure 6-3. Coaxial Mixer A3, Component Identification

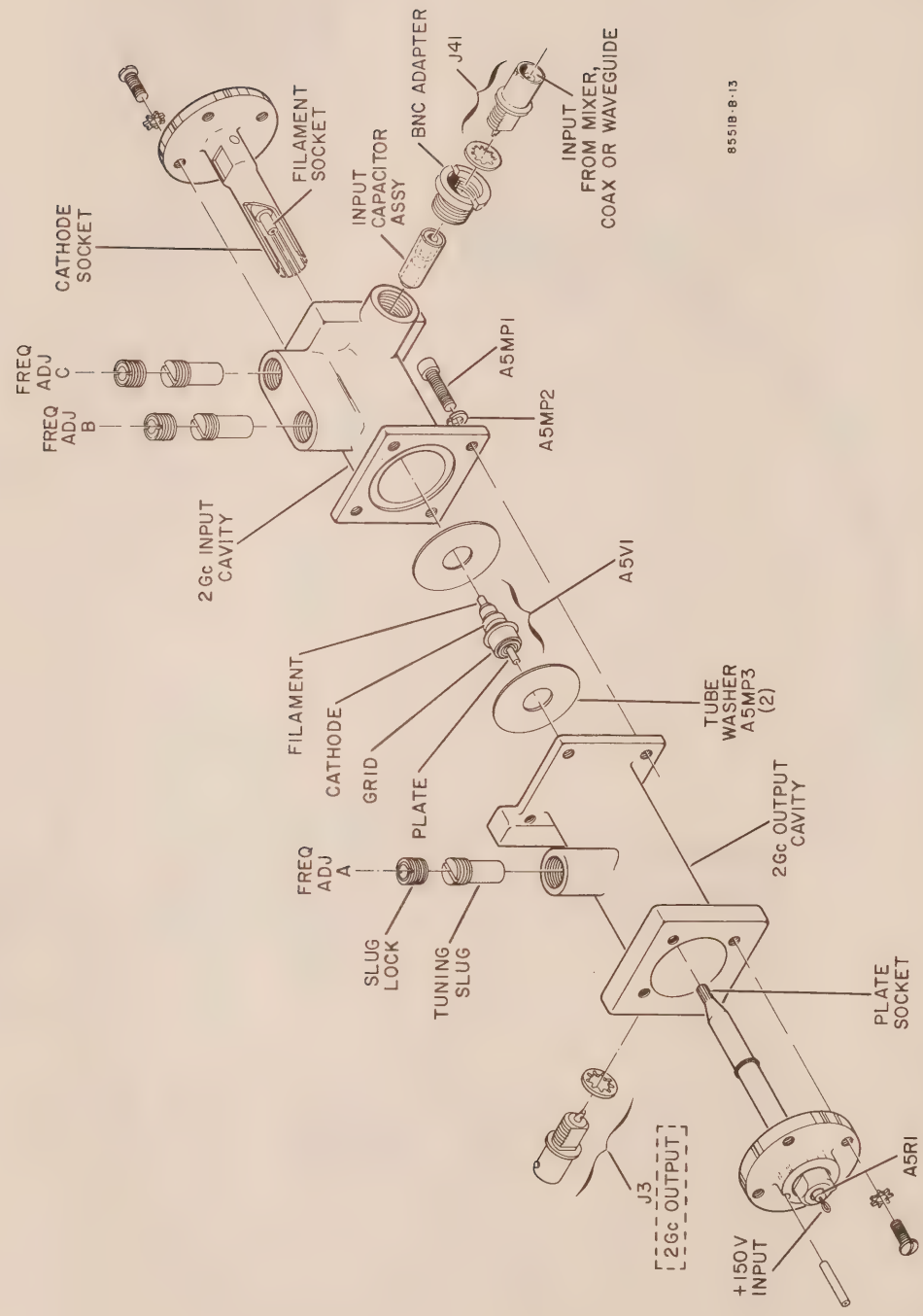


Figure 6-4. 2GC Amplifier Assembly A5, Component Identification

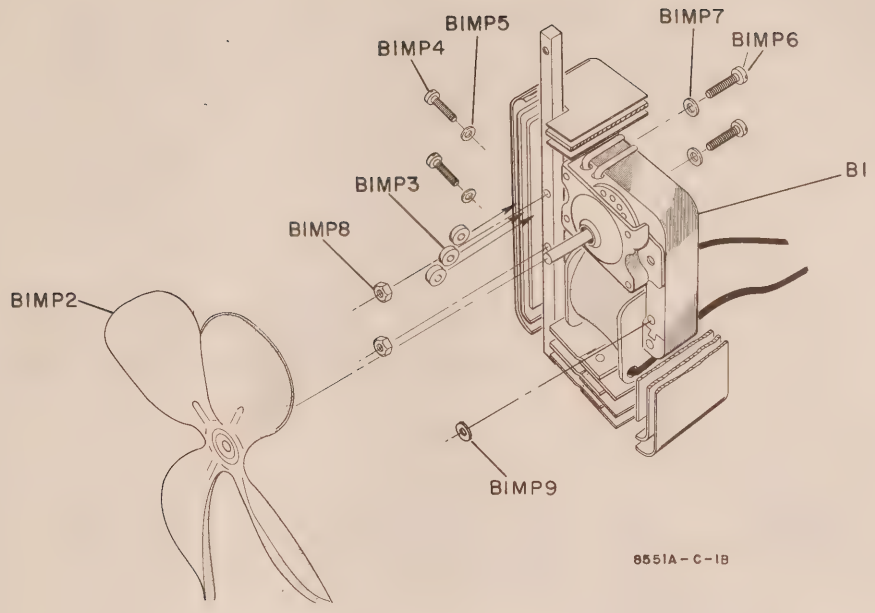


Figure 6-5. Fan Motor Assembly B1MP1, Component Identification

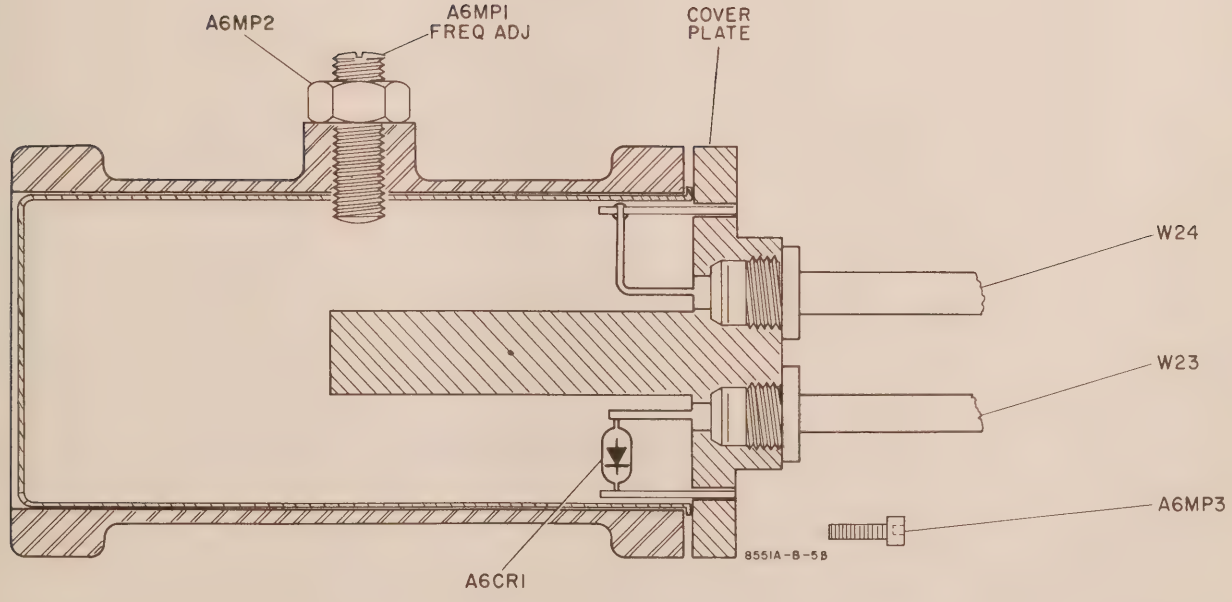


Figure 6-6. Harmonic Generator Assembly A6, Component Identification

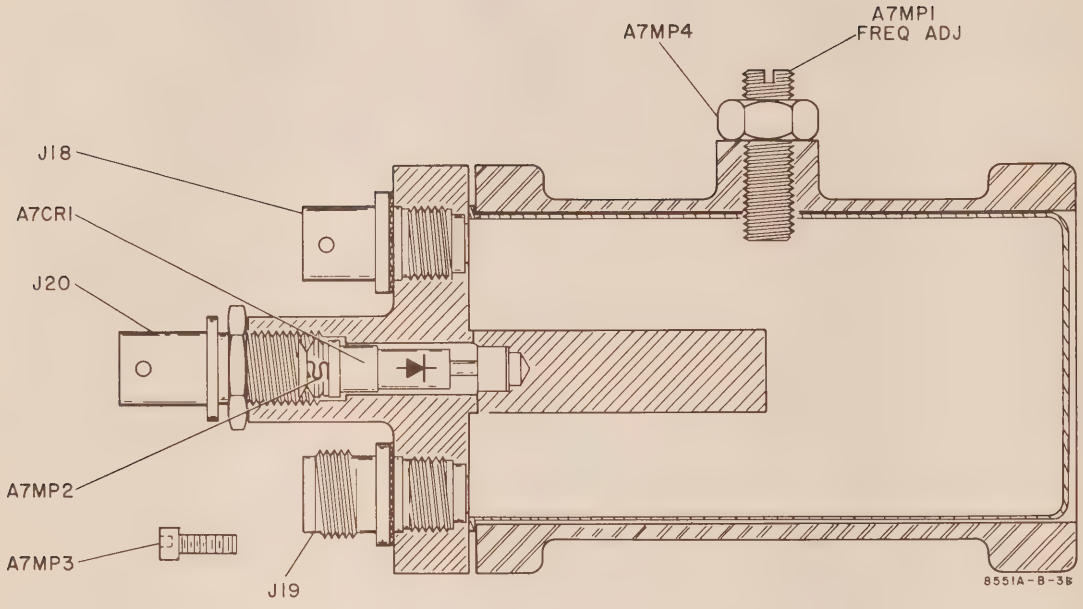


Figure 6-7. 2GC Mixer Assembly A7, Component Identification

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
A3MP6	08551-2314	BEAD:CONDUCTOR SUPPORT	
A3MP7	08551-2315	BEAD:CAVITY	
A3MP8	08551-2309	COVER:CHOKE CAVITY	
	3030-0147	SCREW:SET 6-32 X 3/8 W/LOCK STRIP CHOKE CAVITY ADJ	
A3MP9	08551-2308	BODY:MIXER	
A3MP10	08551-2317	CENTER CONDUCTOR	
A3MP11	08551-0123	GASKET:COUPLER BLOCK	
A3MP12	08551-0119	COVER:FILTER BLOCK	
A3MP13	08551-0121	GASKET:FILTER BLOCK	
A3MP14	3030-0007	SCREW:HEX SOCKET DR CP STL 4-40 X 0.125	
A3MP15	08551-2358	ROD:ADAPTER	
A3R1	0698-5836	R:FXD MET FLM 1K OHM 1% 1/20W	
	1251-1556	CLIP:RESISTOR LEAD	
A4K1	3106-0002	SWITCH:COAXIAL 24V SPDT INCLUDES 3-BNC CONNECTORS J15-J17	
A5	08551-6179	AMPLIFIER ASSY: 2GC 1.F. FIG 6-4	
	08551-2037	SLUG:TUNING	
	08551-2363	SLUG:TUNING(ALTERNATE FOR 08551-2037)	
	08551-2140	LOCK:SLUG(P/O TUNING SLUG)	
A5C1	0140-0069	C:FXD MICA 550 PF 10% 500 VDCW	
A5MP1	3030-0017	SCREW:MACHINE CAP 8-32 X 1)2 INCH	
A5MP2	2190-0017	WASHER:LOCK SPLIT-RING PH BRZ NP 5/64 NO 8	
A5MP3	08551-0021	WASHER: TUBE	
A5R1	0687-2221	R:FXD COMP 2200 OHM 10% 1/2W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A5V1	1960-0002	TUBE-ELECTRON EIA 6299	
	08551-0021	WASHER:TUBE (V1 PLATE)	
A5Z1	08551-4004	FILTER ASSY: 2GC	
A6	08551-6116	HARMONIC GENERATOR ASSY FIG 6-6	
A6CR1	1901-0166	SEMICON DEVICE:DIODE	
A6MP1	0570-0001	SCREW:KNURLED 1/4-20 BR NP FREQ ADJUST	
A6MP2	2950-0004	NUT:HEX 1/4-20	
A6MP3	3030-0065	SCREW:CAP 6-32X7/16	
A7	08551-6117	2GC MIXER ASSY FIG 6-8	
A7CR1	08551-8025	DIODE:SILICON	
A7MP1	0570-0001	SCREW:KNURLED 1/4-20 BR NP TUNING FREQ ADJUST	
A7MP2	5000-0234	CONTACT:SPRING	
A7MP3	3030-0065	SCREW:CAP 6-32X7/16	
A7MP4	2950-0004	NUT:HEX 1/4-20 S.S.	
A8K1	3106-0002	SWITCH:COAXIAL 24V SPDT INCLUDES 3-BNC CONNECTORS J21-J23	

 # See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
	-		
	-		
	-		
	-		
A9	08551-6031	CONVERTER ASSY(SEE TABLE 6-2)	
	-		
	-		
	-		
	-		
	-		
A10	08551-6133	SWITCH ASSY.:SIGNAL IDENTIFIER	
	0370-0112	KNOB	
A10R1	0757-0855	R:FXD MET FLM 68.1K OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R2	0698-3102	R:FXD MET FLM 237 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R3	0698-3102	R:FXD MET FLM 237 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R4	0698-3102	R:FXD MET FLM 237 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R5	0698-3401	R:FXD MET FLM 215 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R6	0698-3401	R:FXD MET FLM 215 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R7	0698-3401	R:FXD MET FLM 215 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R8	0698-3401	R:FXD MET FLM 215 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R9	0757-1060	R:FXD MET FLM 196 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R10	0757-1060	R:FXD MET FLM 196 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R11	0757-1060	R:FXD MET FLM 196 OHM 1% 1/2W	
		FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A10R12	0757-0836	R:FXD MET FLM 7.5K OHM 1% 1/2W	
		FACTORY SELECTED PART;TYPICAL VALUE GIVEN	
A10S1	3100-1594	SWITCH:ROTARY 4-SECT-18-POS	
	0370-0112	KNOB	
A10S2	3101-0004	SWITCH:PUSH SPDT NC MOMENTARY ACT REF CHK	
	0370-0114	KNOB:RED W/ARROW 5/8 IN. OD 1/8 IN.SHAFT	
A11	08551-6170	SWITCH ASSY: FREQUENCY (GC)	
	0370-0112	KNOB	
A11R1	0757-0839	R:FXD MET FLM 10.0K OHM 1% 1/2W	
A11R2	0698-3420	R:FXD MET FLM 34.8K OHM 1% 1/2W	
A11R3	0698-3412	R:FXD MET FLM 3.83K OHM 1% 1/2W	
A11R4	0757-1078	R:FXD MET FLM 1.47K OHM 1% 1/2W	
A11R5	0757-1077	R:FXD MET FLM 15.5K OHM 1%1/2W	
A11R6	0757-0044	R:FXD MET FLM 33.2K OHM 1% 1/2W	
A11R7	0757-0044	R:FXD MET FLM 33.2K OHM 1% 1/2W	
A11R8	0757-1077	R:FXD MET FLM 15.5K OHM 1%1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
A11S1	3100-1593	SWITCH:ROTARY 4-SECT 8-POS	
A12	08551-6048	SWITCH ASSY:SPECTRUM WIDTH	
	0370-0113	KNOB:	
A12R1	0727-0954	R:FXD DEPC FLM 5.5K OHM 1% 1/2W	
A12R2	0727-0195	R:FXD DEPC FLM 50K OHM 1% 1W	
A12R3	0727-0954	R:FXD DEPC FLM 5.5K OHM 1% 1/2W	
A12R4	0727-0410	R:FXD DEPC 256.8K OHM 1/2% 1/2W	
A12R5	0727-0363	R:FXD DEPC 5171 OHM 1/2% 1/2W	
A12R6	0727-0363	R:FXD DEPC 5171 OHM 1/2% 1/2W	
A12R7	0757-0833	R:FXD MET FLM 5.11K OHM 1% 1/2W	
A12R8	2100-0901	R:VAR COMP 7.5K 20% 1/2W W/SPDT SWITCH	
	0370-0114	KNOB:VERNIER	
		VERNIER (ON SPECTRUM WIDTH)	
A12R9	0727-0407	R:FXD DEPC 82.09K OHM 1/2% 1/2W	
A12R10	0727-0364	R:FXD DEPC 5200 OHM 1/2% 1/2W	
A12R11	0727-0364	R:FXD DEPC 5200 OHM 1/2% 1/2W	
A12R12	0727-0176	R:FXD DEPC 24.7K OHM 1% 1/2W	
A12R13	0727-0142	R:FXD DEPC 6.2K OHM 1% 1/2W	
A12R14	0727-0142	R:FXD DEPC 6.2K OHM 1% 1/2W	
A12R15	0727-0148	R:FXD DEPC 7.842K OHM 1% 1/2W	
A12R16	0727-0371	R:FXD DEPC 9760 OHM 1/2% 1/2W	
A12R17	0727-0371	R:FXD DEPC 9760 OHM 1/2% 1/2W	
A12R18	0698-3556	R:FXD MET FLM 16.4K OHM 1/2% 1/4W	
A12S1	3100-0833	ROTARY SWITCH	
A13	08551-6040	HELIX CONTROL ASSY	
A13C1	0140-0180	C:FXD MICA 2000 PF 2% 300 VDCW	
A13C2	0170-0022	C:FXD MY 0.1UF 20% 600VDCW	
A13C3	0170-0022	C:FXD MY 0.1UF 20% 600VDCW	
A13C4	0140-0152	C:FXD MICA 1000PF 5% 300VDCW	
A13C5	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A13C6 THRU A13C8		NOT ASSIGNED	
A13C9	0150-0052	C:FXD CER 0.05 UF 20% 400VDCW	
A13C10	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A13C11	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A13C12 THRU A13C13		NOT ASSIGNED	
A13C14	0160-0182	C:FXD MICA 47PF 5% 300VDCW	
A13CR1	1901-0029	DIODE:SILICON 600PIV	
A13CR2	1902-0214	DIODE:BREAKDOWN SILICON 56.2V 10%	
A13CR3	1901-0033	DIODE:SILICON 100 MA AT +1V 180 WIV	
A13R1	0687-1051	R:FXD COMP 1 MEGOHM 10% 1/2W	
A13R2	0687-1051	R:FXD COMP 1 MEGOHM 10% 1/2W	
A13R3	0764-0046	R:FXD MET OX FLM 33K OHM 5% 2W	
A13R4	0764-0031	R:FXD MET OX FLM 47K OHM 5% 2W ±200 PPM/C	
A13R5	0764-0031	R:FXD MET OX FLM 47K OHM 5% 2W ±200 PPM/C	
A13R6	0727-0255	R:FXD DEPC 800K OHM 1% 1/2W	

 # See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
A13R7	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A13R8	0727-0402	R:FXD DEPC 46.67K OHM 1/2% 1/2W	
A13R9	0727-0178	R:FXD DEPC 24.7K OHM 1% 1/2W	
A13R10	2100-0942	R:VAR MET FLM 50K OHM 20%	
A13R11	0757-0855	R:FXD MET FLM 68.1K OHM 1% 1/2W	
A13R12	2100-0942	R:VAR MET FLM 50K OHM 20%	
A13R13	0765-0007	R:FXD MET FLM 15K OHM 10% 2W	
A13R14	0765-0007	R:FXD MET FLM 15K OHM 10% 2W	
A13R15	0727-0171	R:FXD DEPC 18.37K OHM 1% 1/2W	
A13R16	0727-0202	R:FXD DEPC FLM 83K OHM 1% 1/2W	
A13R17	0758-0018	R:FXD MET OX 15K OHM 5% 1/2W	
A13R18	0698-3412	R:FXD MET FLM 3830 OHM 1% 1/2W ±100PPM/C	
A13R19	2100-0941	R:VAR WW 1000 OHM 5%	
A13R20	0727-0221	R:FXD DEPC 200K OHM 1% 1/2W	
A13R21	0727-0233	R:FXD DEPC 333K OHM 1% 1/2W	
A13R22		NOT ASSIGNED	
A13R23	0727-0187	R:FXD DEPC 37.4K OHM 1% 1/2W	
A13R24	0727-0332	R:FXD DEPC 150K OHM 1% 1/2W	
A13R25	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A13R26	0687-1241	R:FXD COMP 120K OHM 10% 1/2W	
A13R27	0683-8215	R:FXD COMP 820 OHM 5% 1/4W	
A13R28 THRU A13R32		NOT ASSIGNED	
A13R33	0758-0057	R:FXD MET FLM 5600 OHM 5% 1/2W	
A13R34	0727-0348	R:FXD DEPC 80.84K OHM 1/2% 1/2W	
A13R35	0687-1041	R:FXD COMP 100K OHM 10% 1/2W	
A13R36	0764-0007	R:FXD MET FLM 27K OHM 5% 2W	
A13R37	0764-0007	R:FXD MET FLM 27K OHM 5% 2W	
A13R38	0727-0255	R:FXD DEPC 600K OHM 1% 1/2W	
A13R39	0727-0254	R:FXD DEPC 750K OHM 1% 1/2W	
A13R40	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A13R41	0764-0031	R:FXD MET OX FLM 47K OHM 2W	
A13R42	0690-2231	R:FXD COMP 22K OHM 10% 1W	
A13R43	0690-1231	R:FXD COMP 12K OHM 10% 1W	
A13R44	0690-2231	R:FXD COMP 22K OHM 10% 1W	
A13R45	0690-1231	R:FXD COMP 12K OHM 10% 1W	
A13TB1	08551-2175	BLANK BOARD:HELIX CONTROL	
	08551-0050	STIFFENER:PC BOARD	
A13V1	1932-0064	ELECTRON TUBE:6201	
A13V2	1932-0022	ELECTRON TUBE:6DJ8/ECC 88 DUAL TRIODE	
A13V3	1940-0010	ELECTRON TUBE:0G3	
A13V4	1940-0010	ELECTRON TUBE:0G3	
A13V5	1932-0030	ELECTRON TUBE: 12AX7 TWIN TRIODE 9 PIN MIN	
A13V6	1923-0046	ELECTRON TUBE: 6EJ7 PENTODE	
	1220-0009	SHIELD-TUBE	
A13V7	1932-0049	TUBE:ELECTRON TWIN TRIODE CK 647	
A13V8	1923-0045	ELECTRON TUBE: 7239 PENTODE	
	1401-0007	CAP, PLATE, CERAMIC	
A13V9	1923-0045	ELECTRON TUBE: 7239 PENTODE	
	1401-0007	CAP, PLATE, CERAMIC	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
A13V10	2140-0008	LAMP:NEON NE2	
A13V11	2140-0008	LAMP:NEON NE2	
A13XV1	1200-0058	SOCKET-TUBE MINIATURE	
A13XV2	1200-0062	SOCKET:TUBE 9 PIN MINIATURE	
A13XV3	1200-0053	SOCKET:TUBE 7 PIN MINIATURE	
A13XV4	1200-0053	SOCKET:TUBE 7 PIN MINIATURE	
A13XV5	1200-0062	SOCKET:TUBE 9 PIN MINIATURE	
A13XV6	1200-0059	SOCKET-TUBE 9 PIN MINIATURE	
A13XV7	1200-0056	SOCKET-TUBE 9 PIN MINIATURE	
A13XV8	1200-0058	SOCKET-TUBE 9 PIN MINIATURE	
A13XV9	1200-0056	SOCKET-TUBE 9 PIN MINIATURE	
A14	08551-6105	SEARCH DRIVE ASSY	
A14C1	0180-0032	C:FXD ELECT 10UF 10VDCW	
A14C2	0180-0116	C:FXD ELECT TA 6.8UF 10% 35VDCW	
A14C3	0180-0098	C:FXD ELECT 100UF 20% 20VDCW	
A14C4	0180-0098	C:FXD ELECT 100UF 20% 20VDCW	
A14C5	0150-0121	C:FXD CER 0.1UF +80-20% 50 VDCW	
A14C6	0160-0194	C:FXD MY 0.015UF 10%	
A14C7	0170-0084	C:FXD MY 0.068UF 20% 50VDCW	
A14C8	0150-0079	C:FXD CER 3300 PF 10% 500 VDCW	
A14C9	0140-0172	C:FXD MICA 3000 PF 1% 100VDCW	
A14CR1	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A14CR2	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A14Q1	1854-0003	TRANSISTOR NPN SILICON	
A14Q2	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A14Q3	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A14R1	0727-0407	R:FXD DEPC 82.09K OHM 1/2% 1/2W	
A14R2	0727-0232	R:FXD DEPC 312K OHM 1% 1/2W	
A14R3	0727-0244	R:FXD DEPC 500K OHM 1% 1/2W	
A14R4	2100-1437	R:VAR WW 20K OHM 5% 1W RAMP ADJ	
A14R5	0727-0218	R:FXD DEPC 180K OHM 1% 1/2W	
A14R6	2100-0806	R:VAR WW 5K OHM 5% DC BAL ADJ	
A14R7	0727-0348	R:FXD DEPC 80.84K OHM 1/2% 1/2W	
A14R8	0727-0158	R:FXD CFLM 10.1K OHM 1% 1/2W	
A14R9	2100-0806	R:VAR WW 5K OHM 5% 2:1 ADJ	
A14R10	0758-0021	R:FXD MET OX 51K OHM 5% 1/2W	
A14R11		NOT ASSIGNED	
A14R12	0727-0173	R:FXD DEPC 20K OHM 1% 1/2W	
A14R13	0727-0173	R:FXD DEPC 20K OHM 1% 1/2W	
A14R14	0727-0158	R:FXD DEPC FLM 10K OHM 5% 1/2W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A14R15	0727-0109	R:FXD DEPC 1470 OHM 1% 1/2W	
A14R16	0727-0352	R:FXD DEPC 1200 OHM 1/2% 1/2W	
A14R17	0727-0148	R:FXD DEPC 7.842K OHM 1% 1/2W	
A14R18	0727-0106	R:FXD DEPC 1.23K OHM 1/2% 1/2W	
A14R19	0727-0196	R:FXD DEPC 52.6K OHM 1% 1/2W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	

 # See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	℗ Stock No.	Description #	Note
A14R20	0758-0074	R:FXD MET OX 27K OHM 5% 1/2W	
A14R21	2100-1437	R:VAR WW 20K OHM 5% 1W	
A14R22	2100-0806	R:VAR WW 5K OHM 5% SEARCH OSC GAIN ADJ	
A14R23	0727-0075	R:FXD DEPC 490 OHM 1% 1/2W	
A14R24	0764-0046	R:FXD MET OX FLM 33K OHM 5%	
A14R25	0727-0075	R:FXD DEPC 490 OHM 1% 1/2W	
A14R26	0758-0024	R:FXD MET FLM 100 OHM 5% 1/2W	
A14R27	0727-0363	R:FXD DEPC 5171 OHM 1/2% 1/2W	
A14R28	0727-0412	R:FXD DEPC 21.5K OHM 1% 1/2W	
A14R29	0727-0074	R:FXD DEPC 436 OHM 1/2% 1/2W	
A14R30	0683-1005	R:FXD COMP 10 OHM 5% 1/4W	
A14TB1	08551-2171	BOARD:SEARCH DRIVE BARE PC BD	
	08551-0049	CLAMP:SAMPLER/SEARCH DRIVE BD	
A14V1	1932-0027	ELECTRON TUBE: 12AT7 DUAL TRIODE	
A14XV1	1200-0062	SOCKET:TUBE 9 PIN MINIATURE	
	-		
	-		
	-		
	-		
	-		
A15	08551-6100	LOCK ASSEMBLY(SEE TABLE 6-3)	
	-		
	-		
	-		
	-		
	-		
A16	08551-6054	HV TIME DELAY ASSEMBLY	
A16C1	0150-0052	C:FXD CER 0.05 UF 20% 400VDCW	
A16C2	0180-0061	C:FXD ELECT 100UF +100%-10% 15VDCW	
A16C3	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A16C4	0180-0098	C:FXD ELECT 100UF 20% 20VDCW	
A16C5	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A16C6	0180-0269	C:FXD ELECT 1.0 UF +75-10% 150VDCW	
A16CR1/CR2	1901-0084	RECTIFIER:SILICON 50MA 4000PIV TWO DIODE ASSY	
A16CR3 THRU A16CR4		NOT ASSIGNED	
A16CR5	1901-0029	DIODE:SILICON 600PIV	
A16Q1	1855-0001	TRANSISTOR: SIL UNIJUNCTION 2N1671A	
A16R1	0812-0018	R:FXD WW 100 OHM 5% 5W	
A16R2	0690-1011	R:FXD COMP 100 OHM 10% 1W	
A16R3	0690-1021	R:FXD COMP 1000 OHM 10% 1W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A16R4	0687-2741	R:FXD COMP 270K OHM 10% 1/2W	
A16R5	0687-3311	R:FXD COMP 330 OHM 10% 1/2W	
A16R6	0687-6831	R:FXD COMP 68K OHM 10% 1/2W	
A16R7	0687-6831	R:FXD COMP 68K OHM 10% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	℗ Stock No.	Description #	Note
A16R8	2100-0942	R:VAR MET FLM 50K OHM 20% ANODE VOLT. ADJ	
A16R9	0687-3931	R:FXD COMP 39K OHM 10% 1/2W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A16TB1	08551-2179	BOARD:HV TIME DELAY:BARE PC BD	
A17	08551-6049	HELIX VOLTAGE SHAPER ASSY:(STEW. BNO)	
A17C1	0150-0049	C:FXD CER 100 PF 5% 4KV	
A17C2	0150-0036	C:FXD CER 470 PF 20% 6KV FACTORY SELECTED, NOT ALWAYS USED	
A17CR1	1901-0033	DIODE:SILICON 180WV 100MA	
A17CR2	1901-0033	DIODE:SILICON 180WV 100MA	
A17CR3	1901-0033	DIODE:SILICON 180WV 100MA	
A17CR4	1901-0033	DIODE:SILICON 180WV 100MA	
A17CR5	1901-0033	DIODE:SILICON 180WV 100MA	
A17CR6	1901-0033	DIODE:SILICON 180WV 100MA	
A17CR7	1901-0033	DIODE:SILICON 180WV 100MA	
A17CR8	1901-0033	DIODE:SILICON 180WV 100MA	
A17CR9	1901-0033	DIODE:SILICON 180WV 100MA	
A17R1	0757-0312	R:FXD MET FLM 309K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R2	2100-0944	R:VAR MET FLM 200K OHM 5%	
A17R3	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R4	0757-0312	R:FXD MET FLM 309K OHM 1% 1/2W	
A17R4	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R5	2100-0944	R:VAR MET FLM 200K OHM 5%	
A17R6	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R7	0757-0312	R:FXD MET FLM 309K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R8	2100-0945	R:VAR MET FLM 500K OHM 5%	
A17R9	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R10	0757-0312	R:FXD MET FLM 309K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R11	2100-0945	R:VAR MET FLM 500K OHM 5%	
A17R12	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R13	0757-0312	R:FXD MET FLM 309K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R14	2100-0945	R:VAR MET FLM 500K OHM 5%	
A17R15	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R16	0757-0135	R:FXD MET FLM 511K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R17	2100-0945	R:VAR MET FLM 500K OHM 5%	
A17R18	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R19	0757-0135	R:FXD MET FLM 511K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R20	2100-0945	R:VAR MET FLM 500K OHM 5%	
A17R21	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R22	0757-0135	R:FXD MET FLM 511K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R23	2100-0945	R:VAR MET FLM 500K OHM 5%	

 # See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	℗ Stock No.	Description #	Note
A17R24	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R25	0757-0137	R:FXD MET FLM 750K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R26	2100-0945	R:VAR MET FLM 500K OHM 5%	
A17R27	0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	
A17R28	2100-0969	R:VAR MET FLM 50K OHM 20%	
A17R29	0757-0310	R:FXD MET FLM 133K OHM 1% 1/2W	
	-	FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A17R30	0758-0010	R:FXD MET CX FLM 3300 OHM 5% 1/2W	
A17R31	0760-0033	R:FXD MET FLM 249K OHM 1% 2W	
A17R32	0760-0033	R:FXD MET FLM 249K OHM 1% 2W	
A17R33	0760-0033	R:FXD MET FLM 249K OHM 1% 2W	
A17R34	0760-0033	R:FXD MET FLM 249K OHM 1% 2W	
A17R35	2100-0741	R:VAR WW 5K OHM 5%	
A17R36	2100-0741	R:VAR WW 5K OHM 5%	
A17TB1	08551-2176	BOARD:HELIX VOLT-SHAPER (BARE PC BD)	
A18	08551-6045	LV RECTIFIER ASSY:	
A18C1	0180-0144	C:FXD ELECT 200UF -10+100% 25VDCW	
A18C2	0160-0002	C:FXD MY .01UF 10% 600VDCW	
A18C3	0160-0002	C:FXD MY .01UF 10% 600VDCW	
A18C4	0160-0002	C:FXD MY .01UF 10% 600VDCW	
A18C5	0160-0002	C:FXD MY .01UF 10% 600VDCW	
A18C6	0160-0056	C:FXD PAPER 0.047UF 10% 1000VDCW	
A18C7	0160-0056	C:FXD PAPER 0.047UF 10% 1000VDCW	
A18C8	0180-0104	C:FXD ELECT 200 UF 15VDCW	
A18CR1	1901-0025	DIODE:SILICON 100WV 100MA	
A18CR2	1901-0025	DIODE:SILICON 100WV 100MA	
A18CR3	1902-0215	DIODE BREAKDOWN:SILICON 6.49V 5%	
A18CR4 THRU A18CR5		NOT ASSIGNED	
A18CR6	1902-0314	DIODE:SILICON BREAKDOWN 7.50V 5%	
A18CR7	1902-0223	DIODE BREAKDOWN:SILICON 15.4V 5%	
A18CR8	1901-0030	DIODE:SILICON 800PIV	
A18CR9	1901-0030	DIODE:SILICON 800PIV	
A18CR10	1901-0030	DIODE:SILICON 800PIV	
A18CR11	1901-0030	DIODE:SILICON 800PIV	
A18CR12	1901-0036	DIODE:SILICON 1000PIV	
A18CR13	1901-0036	DIODE:SILICON 1000PIV	
A18CR14	1901-0029	DIODE:SILICON 600PIV	
A18CR15	1901-0029	DIODE:SILICON 600PIV	
A18M1	1010-0005	INDICATOR:ELAPSED TIME	
A18R1	0699-0001	R:FXD COMP 2.7 OHM 10% 1/2W	
A18R2	0758-0066	R:FXD MET FLM 620 OHM 5% 1/2W	
A18R3	0812-0017	R:FXD WW 0.25 OHM 5% 3W	
A18R4	0812-0017	R:FXD WW 0.25 OHM 5% 3W	
A18R5	0812-0017	R:FXD WW 0.25 OHM 5% 3W	
A18R6	0687-4721	R:FXD COMP 4700 OHM 10% 1/2W	
A18R7	2100-0091	R:VAR COMP 5000 OHM 30% LIN 1/3W	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	℗ Stock No.	Description #	Note
A18R8	0690-1221	R:FXD COMP 1200 OHM 10% 1W	
A18R9	0687-8211	R:FXD COMP 820 OHM 10% 1/2W	
A18R10	0727-0292	R:FXD DEPC 3 MEGOHM 1% 1/2W	
A18TB1	08551-2177	BOARD:LOW-VOLTAGE RECT.(BARE PC BD)	
	5040-0601	SUPPORT:PLASTIC	
A19	08551-6058	LV POWER SUPPLY	
A19C1	0160-0166	C:FXD MYLAR 0.1UF 10%	
A19C2	0170-0040	C:FXD MY .047 UF 10% 200VDCW	
A19C3	0140-0159	C:FXD MICA 3000PF 300VDCW	
A19C4	0160-0163	C:FXD MY 3300PF 10%	
A19C5	0180-0217	C:FXD AL ELECT. 10UF 250VDCW	
A19C6	0160-0166	C:FXD MYLAR 0.1UF 10%	
A19C7	0170-0040	C:FXD MY .047 UF 10% 200VDCW	
A19C8	0140-0159	C:FXD MICA 3000PF 300VDCW	
A19C9	0160-0163	C:FXD MY 3300PF 10%	
A19C10	0180-0217	C:FXD AL ELECT. 10UF 250VDCW	
A19C11	0170-0022	C:FXD MY 0.1UF 20% 600VDCW	
A19C12	0140-0159	C:FXD MICA 3000PF 300VDCW	
A19C13	0170-0060	C:FXD MY 0.047UF 10% 400VDCW	
A19C14	0160-0845	C:FXD MY 0.22UF 10% 400VDCW	
A19C15	0180-0217	C:FXD AL ELECT. 10UF 250VDCW	
A19C16	0180-0217	C:FXD AL ELECT. 10UF 250VDCW	
A19CR1	1902-0017	DIODE:BREAKDOWN:6.81V 10% 400 MW	
A19CR2	1902-0017	DIODE:BREAKDOWN:6.81V 10% 400 MW	
A19CR3	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR4	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR5	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR6	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR7	1902-0017	DIODE:BREAKDOWN:6.81V 10% 400 MW	
A19CR8	1902-0017	DIODE:BREAKDOWN:6.81V 10% 400 MW	
A19CR9	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR10	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR11	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR12	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR13	1902-0017	DIODE:BREAKDOWN:6.81V 10% 400 MW	
A19CR14	1902-0031	DIODE BREAKDOWN:12.7V 5%	
A19CR15	1901-0025	DIODE:SILICON 100WV 100MA	
A19CR16	1902-0070	DIODE:SILICON BREAKDOWN 6.6V 5%	
A19CR17	1901-0025	DIODE:SILICON 100WV 100MA	
A19K1	0490-0123	RELAY:ARMATURE SPDT 2-AMP/COIL 6VDC	
A19K2	0490-0123	RELAY:ARMATURE SPDT 2-AMP/COIL 6VDC	
A19Q1	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A19Q2	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A19Q3	1854-0003	TRANSISTOR:NPN SILICON	
A19Q4	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A19Q5	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A19Q6	1854-0003	TRANSISTOR:NPN SILICON	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
A19Q7	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A19Q8	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A19Q9	1854-0003	TRANSISTOR:NPN SILICON	
A19R1	0693-4701	R:FXD COMP 47 OHM 10% 2W	
A19R2	0690-6821	R:FXD COMP 6800 OHM 10% 1W	
A19R3	0690-5621	R:FXD COMP 5600 OHM 10% 1W	
A19R4	0686-1005	R:FXD COMP 10 OHM 5% 1/2W	
A19R5	0693-2731	R:FXD COMP 27K OHM 10% 2W	
A19R6	0686-2215	R:FXD COMP 220 OHM 5% 1/2W	
A19R7	0773-0005	R:FXD MET FLM 12K OHM 5% 5W	
A19R8	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A19R9	0693-2731	R:FXD COMP 27K OHM 10% 2W	
A19R10	0686-6825	R:FXD COMP 6800 OHM 5% 1/2W	
A19R11	0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	
A19R12	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A19R13	0730-0065	R:FXD DEPC 90.5K OHM 1% 1W	
A19R14	0811-0266	R:FXD WW 55K OHM 1% 3/4W	
A19R15	0811-0266	R:FXD WW 55K OHM 1% 3/4W	
A19R16	0690-3301	R:FXD COMP 33 OHM 10% 1W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A19R17		NOT ASSIGNED	
A19R18	0690-6821	R:FXD COMP 6800 OHM 10% 1W	
A19R19	0690-5621	R:FXD COMP 5600 OHM 10% 1W	
A19R20	0686-1005	R:FXD COMP 10 OHM 5% 1/2W	
A19R21	0693-2731	R:FXD COMP 27K OHM 10% 2W	
A19R22	0686-2215	R:FXD COMP 220 OHM 5% 1/2W	
A19R23	0773-0006	R:FXD MET FLM 15K OHM 5% 5W	
A19R24	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A19R25	0693-2731	R:FXD COMP 27K OHM 10% 2W	
A19R26	0686-6825	R:FXD COMP 6800 OHM 5% 1/2W	
A19R27	0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	
A19R28	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A19R29	0730-0065	R:FXD DEPC 90.5K OHM 1% 1W	
A19R30	0811-0266	R:FXD WW 55K OHM 1% 3/4W	
A19R31	0811-0268	R:FXD WW 74K OHM 1% 3/4W	
A19R32	0690-4701	R:FXD COMP 47 OHM 10% 1W FACTORY SELECTED PART:TYPDCAL VALUE GIVEN	
A19R33	0690-6821	R:FXD COMP 6800 OHM 10% 1W	
A19R34	0690-5621	R:FXD COMP 5600 OHM 10% 1W	
A19R35	0686-1005	R:FXD COMP 10 OHM 5% 1/2W	
A19R36	0773-0004	R:FXD MET FLM 10K OHM 5% 5W	
A19R37	0693-3331	R:FXD COMP 33K OHM 10% 2W	
A19R38	0686-2215	R:FXD COMP 220 OHM 5% 1/2W	
A19R39	0687-1221	R:FXD COMP 1200 OHM 10% 1/2W	
A19R40	0686-6825	R:FXD COMP 6800 OHM 5% 1/2W	
A19R41	0764-0040	R:FXD MET OX FLM 39K OHM 5%	
A19R42	0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	
A19R43	0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	
A19R44	0764-0040	R:FXD MET OX FLM 39K OHM 5%	
A19R45	0730-0065	R:FXD DEPC 90.5K OHM 1% 1W	
A19R46	0811-0267	R:FXD WW 55K OHM 1% 1W	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
A19R47	2100-0941	R:VAR WW 1000 OHM 5% TYPE V	
A19R48	0811-0269	R:FXD WW 1600 OHM 1% 1/4W	
A19TB1	08551-2180	BARE BOARD:LOW VOLTAGE POWER SUPPLY	
	08551-0022	COVER CAN:A19CR16,A19CR17,A1909	
A20	08551-6057	LV SERIES REGULATOR ASSY	
A20Q1	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
A20Q2	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
A20Q3	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
A20Q4	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
A20Q5	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
A20Q6	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
A21	08551-6007	BOARD ASSY.:METER	
A21C1	0140-0213	C:FXD MICA 2000PF 1% 300VDCW	
A21C2	0160-0161	C:FXD MY 0.01 UF 10% 200VDCW	
A21CR1	1901-0025	DIODE:SILICON 100WV 100MA	
A21CR2	1901-0025	DIODE:SILICON 100WV 100MA	
A21CR3	1901-0025	DIODE:SILICON 100WV 100MA	
A21CR4	1901-0025	DIODE:SILICON 100WV 100MA	
A21R1	0758-0019	R:FXD MET FLM 18K OHM 5% 1/2W	
A21R2	0758-0064	R:FXD MET FLM 36K OHM 5% 1/2W	
A21R3	0758-0035	R:FXD MET FLM 3000 OHM 5% 1/2W	
A21R4	0758-0073	R:FXD MET FLM 24K OHM 5% 1/2W	
A21R5	0758-0021	R:FXD MET FLM 51K OHM 5% 1/2W	
A21R6	0758-0039	R:FXD MET FLM 20K OHM 5% 1/2W	
A21R7	0686-2445	R:FXD COMP 240K OHM 5% 1/2W	
A21R8	0758-0037	R:FXD MET FLM 5100 OHM 5% 1/2W	
A21TB1	08551-2181	BOARD, METER:BARE PC BD	
	08551-6065	CABLE HARNESS METER BOARD	
A22K1	3106-0005	SWITCH:COAXIAL 24V SPDT	
A23	08551-6102	SAMPLER ASSEMBLY	
A23CR1	1901-0169	DIODE:SILICON	
	08551-2041	POST:DIODE	
A23CR2	5080-0221	SEMICON DEVICE:DIODE	

 # See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
A23DC1	08551-6103	SAMPLER:DIRECTIONAL COUPLER ASSY INCL 2 12-IN CABLES W/TYPE N MALE FEMALE	
A23P1	08551-6069	CONNECTOR LOAD ASSY: INCLUDES	
	1250-0045	CONNECTOR:ELECTRICAL RF BNC (PLUG) RECPT	
	5000-0234	SPRING:CONTACT	
	5020-0366	RING:CONTACT	
A23R1	-	R:FXD COMP 9 OHM 5% 3/4W THREE 27-OHM RESISTORS IN PARALLEL PART OF A23P1	
A24	08551-6132	STABILIZATION:SWITCH ASSY	
	0370-0113	KNOB:BLK CONCENTRIC 3/4IN. OD 1/4IN. SHAFT	
A24C1	0150-0050	C:FXD CER 1000PF 600 VDCW	
A24R1	2100-0153	R:VAR 2000 OHM 20% LIN 1/2W	
	0370-0306	KNOB:RED W/ARROW 5/8 IN. OD 1/8 IN.SHAFT	
A24S1	3100-1595	SWITCH:ROTARY 2-SECT 8 POSITION	
A25	08551-6164	BIAS GENERATOR ASSY	
A25C1	0160-0156	C:FXD MY 0.0039 UF 10% 200VDCW	
A25Q1	1854-0071	TRANSISTOR:SILICON NPN 2N3391	
A25Q2	1854-0071	TRANSISTOR:SILICON NPN 2N3391	
A25Q3	1853-0020	TRANSISTOR:SILICON PNP	
A25R1	2100-1762	R:VAR WW 20K OHM 10% LIN 1/2W	
A25R2	0757-0464	R:FXD MET FLM 90.9K OHM 1% 1/8W	
A25R3	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A25R4	0757-0199	R:FXD MET FLM 21.5K OHM 1% 1/8W	
A25R5	0757-0059	R:FXD MET FLM 1 MEGOHM 1% 1/2W	
A25R6	0686-2055	R:FXD COMP 2 MEGOHM 5% 1/2W	
A25R7	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A25R8	0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	
A25R9	0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	
A25TB1	08551-2306	BOARD:MIXER BARE PC BD	
	-		
	-		
	-		
	-		
	-		
AT1	0960-0008	CIRCULATOR:3-PORT	
	08551-0114	BRACKET:CIRCULATOR SUPPORT	
AT2	08551-6071	ATTENUATOR:FXD COAXIAL 3DB	
B1	3140-0010	MOTOR:AC 1/175 HP 2800 RPM	FIG 6-5
	5060-0878	FILTER ASSY:AIR FAN	
B1MP1	08551-6043	FAN MOTOR ASSY	
B1MP2	3160-0013	BLADE FAN 4 BLADES 4-1/2	
B1MP3	08551-2155	SPACER	
B1MP4	2200-0010	SCREW:MACHINE RH SST 4-40 X 3/4	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
B1MP5	2190-0004	WASHER:LOCK PH BRZ NP 0.270 OD FOR#4 SCREW	
B1MP6	2360-0016	SCREW:MACHINE RH SST 6-32 X 1-1/4	
B1MP7	2190-0007	WASHER:NO.6 W/INTERNAL LOCK	
B1MP8	2420-0001	NUT:HEX ST NP 6-32 X 5/16 W/LOCKWASHER	
B1MP9	3050-0066	WASHER:FLAT BRASS 6 X 3/8 OD	
C1	0180-0155	C:FXD TA 2.2UF 20% 20VDCW	
C2		NOT ASSIGNED	
C3	0150-0024	C:FXD CER 0.02UF +80%-20% 600VDCW	
		PART OF S4	
C4	0160-0163	C:FXD MY 3300PF 10% 200VDCW	
		PART OF S4	
C5	0160-0163	C:FXD MY 3300PF 10% 200VDCW	
		PART OF S4	
C6	0150-0052	C:FXD CER 0.05 UF 20% 400VDCW	
		PART OF S4	
C7	0160-3018	C:FXD PAPER 3 UF +20-10% 2000VDCW	
	08551-0126	BRACKET, CLAMPING	
	1210-0004	CLAMP:CAPACITOR	
C8	0160-3018	C:FXD PAPER 3 UF +20-10% 2000VDCW	
	08551-0128	BRACKET, CLAMPING	
C9	0180-0052	C:FXD ELECT 2X10UF 450VDCW	
C10		PART OF C9	
C11	0150-0052	C:FXD CER 0.05UF 20% 400VDCW	
C12	0160-2044	C:FXD PAPER 0.1 UF 10% 2000VDCW	
	0160-2045	BRACKET:CAPACITOR	
	-	NUT:10-32	
C13		NOT ASSIGNED	
C14	0180-0042	C:FXD ELECT 120UF 350VDCW	
C15	0180-0042	C:FXD ELECT 120UF 350VDCW	
C16	0180-0042	C:FXD ELECT 120UF 350VDCW	
C17	0180-0128	C:FXD ELECT 2800UF -10+30% 30VDCW	
C18 THRU			
C19		NOT ASSIGNED	
C20	0180-0136	C:FXD ELECT 10UF -10+100% 50VDCW	
C21	0160-0151	C:FXD CER 4700PF +80%-20% 4000VDCW	
C22	0180-0205	C:FXD ALUM. 12 UF -10 +75% 150VDCW	
C23		NOT ASSIGNED	
C24	0170-0086	C:FXD MY 0.22 UF 20% 50VDCW	
C25	0150-0023	C:FXD CER 2000 PF 20% 1000VDCW	
C26	0160-0845	C:FXD MY 0.22 UF 10% 400VDCW	
C27	0160-0845	C:FXD MY 0.22 UF 10% 400VDCW	
C28	0180-0063	C:FXD ELECT 500UF -10%+100% 3VDCW	
CR1	1901-0032	DIODE:SILICON 100PIV 15A	
CR2	1901-0032	DIODE:SILICON 100PIV 15A	
CR3	1901-0025	DIODE:SILICON 100WV 100MA	
DS1	2140-0015	LAMP:GLOW NEON NE-2H(STANDBY)	
	5040-0234	LAMPHOLDER	
	5040-0235	LAMP:BASE	
DS2	2140-0015	LAMP:GLOW NEON NE-2H(ON)	
	5040-0234	LAMPHOLDER	
	5040-0235	LAMP:BASE	
DS3	2140-0015	LAMP:GLOW NEON NE-2H(REDUCE SPEC WIDTH)	
	5040-0234	LAMPHOLDER	
	5040-0235	LAMP:BASE	

 # See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	℗ Stock No.	Description #	Note
DS4	2140-0010	LAMP:INCANDESCENT 6 VOLT	
DS5	2140-0010	LAMP:INCANDESCENT 6 VOLT	
DS6	2140-0010	LAMP:INCANDESCENT 6 VOLT	
DS7	2140-0010	LAMP:INCANDESCENT 6 VOLT	
DS8	2140-0010	LAMP:INCANDESCENT 6 VOLT ILLUMINATES FREQUENCY SCALE	
	1450-0110	LAMPHOLDER ASSEMBLY:5-SOCKETS	
DS9	2140-0015	LAMP:GLOW NEON NE-2H(SPEC WIDTH UNCAL)	
	5040-0234	LAMPHOLDER	
	5040-0235	LAMP:BASE	
F1	2110-0029	FUSE:CARTRIDGE 3 AMP 125V SLOW BLOW	
	2110-0059	FUSE:CARTRIDGE 1-1/2A SLO-BLO	
FL1	08551-6000	LOW PASS FILTER ASSY	
J1	1250-0102	CONNECTOR:BNC FEMALE	
	5020-3334	CONNECTOR SHELL:BULKHEAD TYPE N(P/O W13)	
	5020-3249	PIN:FEMALE	
	1250-0815	INSULATOR:RF CONNECTOR	
	00354-229	CONDUCTOR:CENTER	
J2	1250-0102	CONNECTOR:BNC FEMALE PART OF W17 EXT MIXER INPUT	
J3	1250-0083	CONNECTOR:BNC PART OF A5 2GC OUTPUT	
J4	1250-0102	CONNECTOR:BNC FEMALE 2 GC I.F. INPUT P/O W3	
J5	-	CONNECTOR:BNC FEMALE 200 MC OUTPUT P/O W25	
J6	-	CONNECTOR:BNC FEMALE 200 MC INPUT P/O W26	
J7	1250-0102	CONNECTOR:BNC I.F. OUTPUT P/O W27	
J8	1250-0102	CONNECTOR:BNC SWEEP INPUT	
J9	1251-0143	CONNECTOR:FEMALE 14-CONTACT JACK	
J10	-	CONNECTOR:TYPE N FEMALE LO OUTPUT	
J11	-	CONNECTOR:BNC TERM P/O W20	
J12	1250-0236	CONNECTOR:RF CABLE JACK BNC PART OF W16	
J13	1250-0212	CONNECTOR:JACK CHASSIS BNC A2 MIXER COUPLER 200MC OUTPUT	
J14	1250-0083	CONNECTOR:JACK CHASSIS BNC PART OF A3 A3 COAX MIXER OUTPUT	
J15		PART OF A4K1	
J16		PART OF A4K1	
J17		PART OF A4K1	
J18	1250-0212	CONNECTOR:JACK CHASSIS BNC 2 GC INPUT TO A7 2 GC MIXER	
J19	1250-0792	CONNECTOR:RF BNC BLKHD MOUNT JACK RECPT 1800MC INPUT TO A7 2GC MIXER	
J20	1250-0794	CONNECTOR:RF TNC BLKHD MOUNT JACK RECPT	
J20		200 MC OUTPUT FROM A7 2 GC MIXER	
J21		PART OF A8K1	
J22		PART OF A8K1	
J23		PART OF A8K1	
J24	1250-0212	CONNECTOR:JACK CHASSIS BNC A9 CONVERTER 200 MC INPUT	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
J25	1250-0793	CONNECTOR:RF BNC RT-ANGLE BLKHD JACK RECPT A9 CONVERTER 180 MC OUTPUT	
J26	1250-0212	CONNECTOR:JACK CHASSIS BNC A15 LOCK ASSEMBLY 10 MC OUTPUT	
J27	1250-0793	CONNECTOR:RF BNC RT-ANGLE BLKHD JACK RECPT A15 LOCK ASSY DISC. OUTPUT	
J28	1250-0149	CONNECTOR:RF BNC RIGHT-ANGLE 10MC INPUT TO SAMPLER	
	1460-0091	SPRING:COMPRESSION 0.09-0.11D X 1-3/8	
J29	1250-0149	CONNECTOR:RF COAXIAL BNC RT-ANGLE RECEPT	
	-	A15 LOCK ASSY PULSE INPUT FROM A23 SAMPLER	
J30	1250-0793	CONNECTOR:RF BNC RT-ANGLE BLKHD JACK RECPT A15 LOCK ASSY PULSE AMPL OUTPUT	
J31	-	CONNECTOR:P/O BWO V5 OUTPUT TO A3 ASSY	
J32	-	CONNECTOR:P/O BWO V5 OUTPUT TO A23 ASSY	
J33	1250-0212	CONNECTOR:JACK CHASSIS BNC A9 CONVERTER 20MC OUTPUT	
	5000-0234	CONTACT:SPRING	
J34	1251-0095	RECEPTACLE:SWITCHED LINE OUTPUT	
	1251-0156	SPRING:GROUND PIN	
J35	1250-0102	CONNECTOR:BNC FEMALE PRESELECTOR DRIVE OUTPUT	
J36		TYPE N FEMALE: PART OF A22K1	
J37		TYPE N FEMALE: PART OF A22K1	
J38		TYPE N FEMALE: PART OF A22K1	
J39	1250-0720	CONNECTOR:INPUT TO MIXER/COUPLER PART OF A2	
J40	08551-2313	CONNECTOR:INPUT TO COAXIAL MIXER PART OF A3	
K1	0490-0115	RELAY:ARMATURE 3PDT/COIL 6VDC	
K2	0490-0115	RELAY:ARMATURE 3PDT/COIL 6VDC	
K3	0490-0039	RELAY:DPDT	
K4	0490-0114	RELAY:ARMATURE SPDT/COIL 125MW SENSITIVITY	
M1	1120-0156	MICROAMMETER:25UA-0-25UA ZERO CENTER OSC TRACK BALANCE	
MP1 THRU MP7		NOT ASSIGNED	
MP8	0360-0018	TERM BD:4 INSULATED 1 GROUNDING TIE POINT FOR LV RECT A18 CKTS	
MP9	0360-0018	TERM BD:4 INSULATED 1GROUNDING TIE POINT FOR CONVERTER CKTS	
MP10	5060-0878	FILTER ASSY:AIR	
MP11	08551-0009	HOLDER:AIR FILTER	
MP12	08551-0023	SCREEN:FILTER	
MP13	08551-0028	RETAINER:SCREEN	
Q1	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
Q2	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	

 # See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
Q3	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
	1200-0147	SLEEVE:INSULATOR NYLON NO.4	
Q4	1850-0064	TRANSISTOR:GERMANIUM 2N1183 PNP	
	1200-0076	INSULATOR:TRANSISTOR	
	1200-0087	CLAMP:TRANSISTOR	
	1200-0092	BUSHING:TRANSISTOR	
Q5	1850-0062	TRANSISTOR:PNP 2N404	
	1205-0025	HEAT SINK:NUT	
	1205-0026	HEAT SINK:BODY	
Q6	1850-0062	TRANSISTOR:PNP 2N404	
	1205-0025	HEAT SINK:NUT	
	1205-0026	HEAT SINK:BODY	
R1	0758-0010	R:FXD MET OX 3.3K OHM 5% 1/2W	
R2	0758-0010	R:FXD MET OX 3.3K OHM 5% 1/2W	
R3	2100-1569	R:VAR COMP 5K OHM 20% LIN 1/2W SENSITIVITY	
	0370-0025	KNOB: P/O SENSITIVITY	
R4	2100-0053	R:FXD WW 10K OHM 10% LIN 2W SPECTRUM CENTERING	
R5	2100-0758	R:VAR WW 200K OHM 3% LIN 10-TURN TUNE	
	0370-0111	KNOB:CRANK 1-INCH DIAMETER 1/4 IN SHAFT	
	0370-0050	HANDLE:CRANK ONLY P/O TUNE	
	2410-0001	SCREW:MACHINE OV SST PHILLIPS DR 6-32X5/8 HOLDS KNOB ON CRANK	
R6	08551-8017	R:VAR WW 10K OHM P/O TUNE	
R7	2100-0803	R:VAR WW 20K OHM 5% LINEAR 360 DEGREE ROT GANGED TO TUNE 2:1 POTENTIOMETER	
R8		NOT ASSIGNED	
R9	0683-3315	R:FXD COMP 330 OHM 5% 1/4W PART OF S4	
R10	0683-2415	R:FXD COMP 240 OHM 5% 1/4W PART OF S4	
R11	0683-1045	R:FXD COMP 100K OHM 5% 1/4W PART OF S4	
R12	0683-2215	R:FXD COMP 220 OHM 5% 1/4W PART OF S4	
R13	0683-1045	R:FXD COMP 100K OHM 5% 1/4W PART OF S4	
R14	0683-1315	R:FXD COMP 130 OHM 5% 1/4W PART OF S4	
R15	0683-1045	R:FXD COMP 100K OHM 5% 1/4W PART OF S4	
R16	08551-8013	R: CAP DISCH:FXD, 3-MEGOHM, 10% 1/2W CAPACITOR DISCHARGE	
R17	08551-8013	R: CAP DISCH:FXD, 3-MEGOHM, 10% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
R18	0687-3321	R:FXD COMP 3300 OHM 10% 1/2W	
R19	0687-3321	R:FXD COMP 3300 OHM 10% 1/2W	
R20	0693-2221	R:FXD COMP 2200 OHM 10% 2W	
R21	0687-4741	R:FXD COMP 470K OHM 10% 1/2W	
R22	0690-1041	R:FXD COMP 100K OHM 10% 1W	
R23	0687-1011	R:FXD COMP 100 OHM 10% 1/2W	
R24	0687-3301	R:FXD COMP 33 OHM 10% 1/2W	
R25	0687-1021	R:FXD COMP 1000 OHM 10% 1/2W	
R26	0687-1021	R:FXD COMP 1000 OHM 10% 1/2W	
R27	0687-1011	R:FXD COMP 100 OHM 10% 1/2W	
R28	0687-3301	R:FXD COMP 33 OHM 10% 1/2W	
R29	0687-1021	R:FXD COMP 1000 OHM 10% 1/2W	
R30	0687-1021	R:FXD COMP 1000 OHM 10% 1/2W	
R31 THRU R34		NOT ASSIGNED	
R35	0687-1011	R:FXD COMP 100 OHM 10% 1/2W	
R36	0687-1011	R:FXD COMP 100 OHM 10% 1/2W	
R37		NOT ASSIGNED	
R38	0689-1505	R:FXD COMP 15 OHM 5% 1W	
R39	08551-8013	RESISTOR, CAP. DISCHARGE 3 MEGOHM	
R40	0690-1541	R:FXD COMP 150K OHM 10% 1W	
R41	0690-1541	R:FXD COMP 150K OHM 10% 1W	
R42	0690-1541	R:FXD COMP 150K OHM 10% 1W	
R43	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
R44	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
R45		NOT ASSIGNED	
R46	0687-1031 -	R:FXD COMP 10K OHM 10% 1/2W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
R47	0816-0015	R:FXD WW 50 OHM 10% 10W	
R48	0687-1041	R:FXD COMP 100K OHM 10% 1/2W	
R49	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
R50	08551-6070	R:FXD 50-OHM COAX TERM-PLUGS INTO LO OUTPUT	
R51	08551-6070	R:FXD 50-OHM COAX TERMINAL PLUGS INTO MIXER/COUPLER TERMINATES BWO LINE TO RF MIXERS	
R52	0693-1011	R:FXD COMP 100 OHM 10% 2W	
R53	0758-0021	R:FXD MET OX 51K OHM 5% 1/2W	
R54	0758-0021	R:FXD MET OX 51K OHM 5% 1/2W	
R55	2100-0011	R:VAR COMP 5000 OHM LIN 1/2W SIGNAL IDENT CAL	
R56	2100-0730	R:VAR COMP 100 OHM 10% LIN 2.2W FREQUENCY VERNIER	
R57	2100-0044	R:VAR COMP 50K OHM 10% 2W STAB TUNE	
R58	0684-3331	R:FXD COMP 33K OHM 10% 1/4W	
R59	2100-0141	R:VAR COMP 50K OHM 20% LIN 1/4W	
R60	2100-0141	R:VAR COMP 50K OHM 20% LIN 1/4W	
R61	1250-0207	R:FXD COAX TERM 50 OHM EXT MIXER INPUT	
RT1	0839-0006	THERMISTOR:10 OHM 10%	
S1		NOT ASSIGNED	

 # See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
S2	3101-0041	SWITCH:TOG DPDT 3 POS 15 AMP 125VAC LINE SWITCH	
S3	3101-0034	SWITCH:SLIDE 4 PDT 0.5 AMP 125 VDC 115/230V LINE VOLTAGE	
S4	08551-6059 3100-0835	SWITCH ASSY:GAIN COMPENSATING SWITCH:ROTARY PART OF S4	
T1	9100-0269	TRANSFORMER:POWER FILAMENT SUPPLY	
T2	9100-0270	TRANSFORMER:POWER LV	
T3	9100-0268	TRANSFORMER:POWER 1000-150 VOLTS HV	
V1	1923-0048 1401-0006	ELECTRON TUBE: 8068 BEAM PENTODE CAP, PLATE, CERAMIC	
V2	1923-0048 1401-0006	ELECTRON TUBE: 8068 BEAM PENTODE CAP, PLATE, CERAMIC	
V3		NOT ASSIGNED	
V4	1940-0010	ELECTRON TUBE:0G3	
V5	1951-0030	ELECTRON TUBE:BWO 2-4GC STEWART	
V6	1921-0005	ELECTRON TUBE: 6C4 TRIODE	
W1	08551-6165	CABLE ASSY:COAX MIXER OUTPUT (A3) 17-IN TRI-SHIELD COAX TERM W/ BNC MALE	
W2	08551-6013	CABLE ASSY:EXT JUMPER 2GC IF AMPL TUNED 9 IN COAX TERM W/TNC AND BNC MALE	
W3	08551-6037	CABLE ASSY:A7 2GC MIXER IN 10-IN COAX ONE END TERM W/BNC MALE OTHER BNC FEMALE	
W4	08551-6014	CABLE ASSY:2GC MIXER OUTPUT(A7) 13 IN TRI-SHIELD COAX TERM W/ BNC MALE	
W5	08551-6012	CABLE ASSY:LP FLT OUTPUT 6-INCH COAX TERM. W/BNC MALES	
W6	08551-6012	CABLE ASSY:EXT JUMPER 200MC 6-IN COAX TERM W/BNC MALES	
W7	08551-6013	CABLE ASSY:A2 MIXER/COUPLER 200MC OUTPUT 9-IN COAX TERM W/BNC MALES	
W8	8120-0078	CABLE POWER 7.5FT.	
W9	08551-6038	CABLE ASSY:CONTROL-INTERCONNECTING 14-COND CABLE TERM W/14-PIN CONNECTORS	
W10	08551-6012	CABLE ASSY:6-INCH COAX TERM.W/ BNC MALE FROM 10MC OSC A15A1 TO SAMPLER A23	
W11	08551-6014	CABLE ASSY:INTERUNIT 20 MC	
W12	08551-6014	CABLE ASSY:INTERUNIT SWEEP 13-IN TRI-SHIELD TERM. W/BNC MALES	
W13	08551-6177	CABLE ASSY:15 IN TRI-SHIELD COAX TERM	
W13J1	1250-0102	CONNECTOR:BNC FEMALE TYPE N	
W13MP1	00354-229	CONDUCTOR:CENTER	
W13MP2	1250-0815	INSULATOR:RF CONNECTOR	
W13MP3	5020-3249	PIN:FEMALE	
W13MP4	5020-3334	CONNECTOR SHELL:BULKHEAD TYPE N	
W14	08551-6178 1250-0916 1250-0917	CABLE ASSY:8-1/2" TRI-SHIELD COAX TERM BODY:RF CONNECTOR CONTACT:RF CONNECTOR	
W15	08551-6153	CABLE ASSY:18" TRI-SHIELD COAX TERM TYPE N TO TNC MALES A22 TO 200MC MIXER	
W16	08551-6027	CABLE ASSY:A2 MIXER/COUPLER INPUT 24",3-SHIELD SOLID CNTR COAX:FEMALE TNC	
W17	08551-6020	CABLE ASSY:EXT MIXER INPUT 17" COAX TERM W/FEMALE PIN	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
W18		CABLE:RF FROM BWO TO A3 COAX MIXER PART OF COUPLER BLOCK ASSY 08551-6168	
W19		CABLE:CARRIES BWO RF FROM A3 TO A2 MIXER PART OF COUPLER BLOCK ASSY 08551-6168	
W20	08551-6021	CABLE ASSY:LO OUTPUT PART OF A2 7-INCH COAX TERM. W/SPL FEMALE BNC	
W21	08551-6022	CABLE ASSY:A2 MIXER/COUPLER FLT OUTPT 7-IN 3-SHIELD SOLID CNTR COAX W/MALE	
W22	08551-6180	CABLE ASSY:A5 2GC I F AMPL IN PUT 17-IN TRI-SHIELD COAX TERM W/MALE BNC	
W23	08551-6023	CABLE ASSY:180 MC FROM A6 HARM. GEN TO A9 CONVERTER ASSY-20-IN COAX PART OF A6	
W24	08551-6024	TUNED CABLE ASSY: FROM A6 HARM.GEN TO A7 2GC MIXER-22 IN COAX PART OF A6	
W25	08551-6037	CABLE ASSY:FROM A8 COAX SW TO 200 MC 10-IN COAX BNC MALE TO BNC FEMALE	
W26	08551-6037	CABLE ASSY: FROM 200MC INPUT TO A9 CONVERTER:10-IN COAX BNC MALE TO BNC FEMALE	
W27	08551-6037	CABLE ASSY: FROM A9 CONVERTER TO I.F. OUTPUT 10-IN COAX BNC MALE TO BNC FEMALE	
W28	08551-6063-9	CABLE ASSY:A15 DISC. OUTPUT TO A13 HELIX CONT-24-IN COAX TERM W BNC	
W29		CABLE ASSY:A23 SAMPLER TO AT1(W29) PART OF A23DC1	
W30		PART OF A23DC1 SAMPLER LO OUTPUT(W30)	
W31	08551-6063-8	CABLE ASSY:A14 SEARCH DRIVE TO A15 LOCK,28-IN COAX TERM. W/MALE B NC	
W32	08551-6127	CABLE ASSY: BWO V5 TO CIRCULATOR(AT1) 11 IN COAX TERM. W/TYPE N MALES	
W33	08551-6136	CABLE ASSY:FM A13 BD TO REAR PANEL J35	
W34	08551-6181	CABLE ASSY:9-IN TRI-SHIELD COAX TERM	
	1250-0916	BODY:RF CONNECTOR	
	1250-0917	CONTACT:RF CONNECTOR	
W35	08551-6161	CABLE ASSY:16 IN TRI-SHIELD COAX(P/O A2)	
XA13A	1251-0194	CONNECTOR:PRINTED CIRCUIT 15-CONTACT MATES WITH A13A	
XA13B	1251-0194	CONNECTOR:PRINTED CIRCUIT 15-CONTACT MATES WITH A13B	
XA14A	1251-0194	CONNECTOR:15 CONTACT MATES W/A14A	
XA14B	1251-0158	CONNECTOR:6 CONTACTS MATES W/A14B	
XA15 THRU XA18		NOT ASSIGNED	
XA19A	1251-0194	CONNECTOR:15 CONTACTS MATES W/A19A	
XA19B	1251-0172	CONNECTOR:22 CONTACTS MATES W/A19B	
XF1	1400-0084	POST:FUSEHOLDER	
XV1	1200-0002	SOCKET:VACUUM TUBE OCTAL CERAMIC	
XV2	1200-0002	SOCKET:VACUUM TUBE OCTAL CERAMIC	
XV3		NOT ASSIGNED	
XV4	1200-0009	SOCKET:TUBE 7-PIN MINIATURE	

See list of abbreviations in introduction to this section

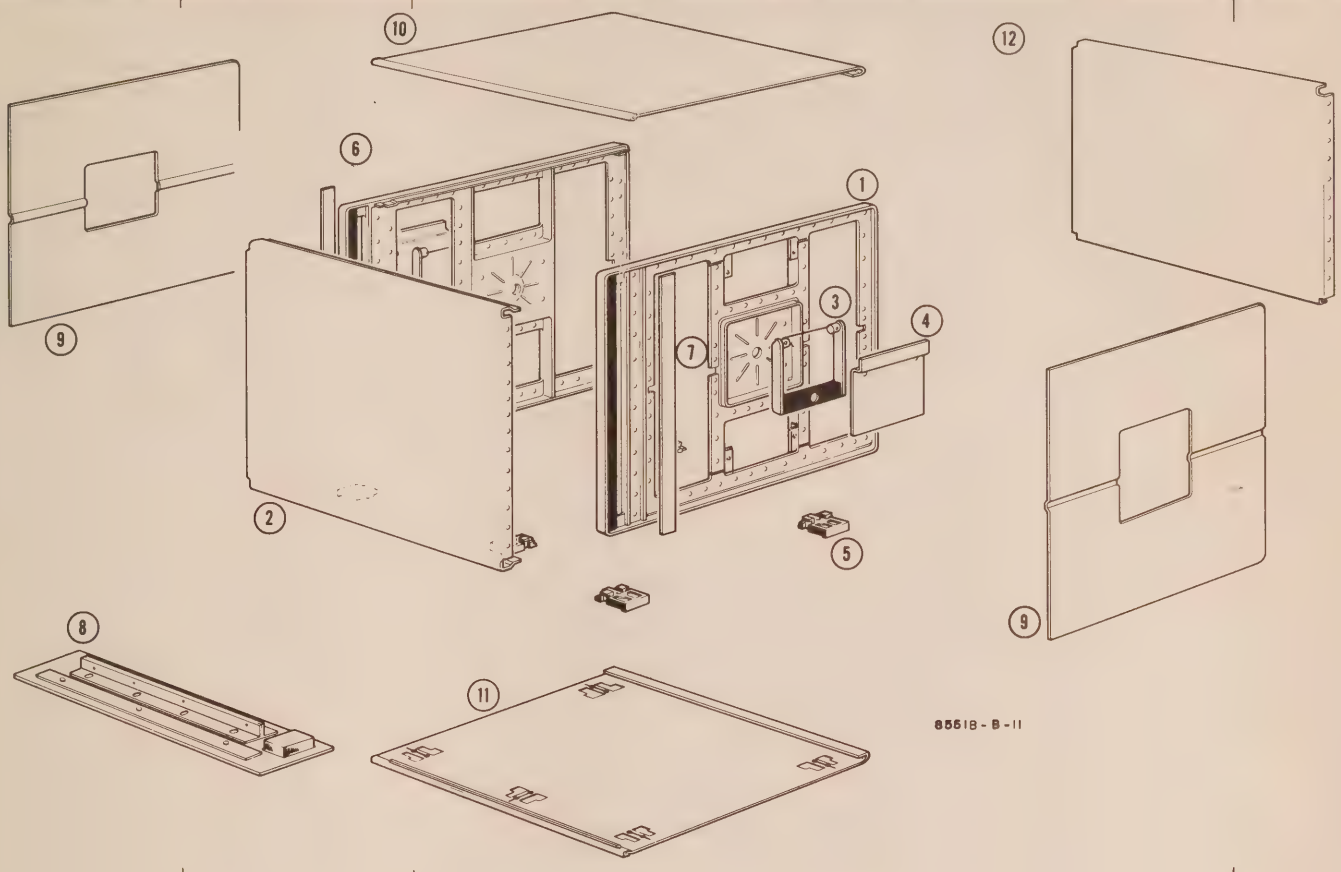
Table 6-1. Model 8551B Reference Designation Index, General (Cont.)

Reference Designation	Stock No.	Description #	Note
XV5		NOT ASSIGNED	
XV6	1200-0009	SOCKET:TUBE 7 PIN	
Z1	9110-0104	LINE FILTER:LOW-PASS INCL PWR PLUG THAT MATES W/PWR CABLE W8	
Z2	08551-4003	FILTER:RF	
	-		
	-		
	-		
	-		
	-		
		MISCELLANEOUS	
	08551-4002	DIAL DRUM ASSY FIG 6-8	
	08551-6123	EXTENDER: PC 15-PIN	
	08551-6122	EXTENDER:PC 22-PIN	
	08551-6166	FRONT PANEL ASSY	
	08551-2052	WINDOW	

See list of abbreviations in introduction to this section

Table 6-1. Model 8551B Reference Designation Index, General (Cont'd)

Reference Designation	℗ Stock No.	Description #	Note



			TQ
1.	08551-6230	FRAME ASSEMBLY: RIGHT SIDE	1
	0590-0053	#6-32 NUT-CAPTIVE, J-TYPE FOR 0.125"	14
2.	08551-0115	FRONT PANEL	1
	2530-0011	#8-32 X 3/8"FH SLOT DR W/INTERNAL LOCKWASHER	10
3.	5060-0763	HANDLE ASSEMBLY	2
4.	5060-0765	RETAINER: HANDLE	2
	2550-0013	#8-32 x 5/16"BH, PHILLIPS DRIVE	4
5.	5060-0767	FOOT ASSEMBLY	5
6.	5060-0807	FRAME ASSEMBLY: LEFT SIDE	1
7.	5000-0055	TRIM: ALUMINUM STRIP	2
8.	08551-6135	KIT: RACK MOUNTING	1
9.	5000-0750	COVER: SIDE, UNPERFORATED	2
	2370-0020	#6-32 X 3/16", 100°FH, PHILLIPS DRIVE	8
10.	5060-0740	COVER ASSEMBLY: TOP, UNPERFORATED	1
	2370-0021	#6-32 X 7/16", PHILLIPS DRIVE	4
11.	5060-0752	COVER ASSEMBLY: BOTTOM, UNPERFORATED	1
	2370-0021	#6-32 X 7/16"FH, PHILLIPS DRIVE	4
12.	08551-0103	REAR PANEL	1
	2515-0017	#8-32 X 1/4", RECESSED PHILLIPS, PANHEAD W/INT LOCK	4

 # See list of abbreviations in introduction to this section

Ref Desig	Index No.	Description	hp Stock No.
	1	Screw, RH 8-32 x 1-1/4	2520-0011
	2	Lockwasher, No. 8 internal teeth	2190-0009
	3	Washer, flat 1/4ID x 3/8OD	3050-0017
	4	Support, pulley	08551-2258
	5	Support, dial	08551-2257
	6	Mask, drum	08551-0016
	7	Screw, RH 4-40 x 1/4 w/lockwash	2200-0004
	8	Subpanel	08551-2250
	9	Screw, BH 8-32 x 3/8 w/lockwash	2550-0007
	10	Ring, retainer, grip 3/16	0510-0053
	11	Shaft, pulley	08551-2272
	12	Pulley	00692-266
	13	Pulley-Delrin	08551-2249
	14	Axle, pulley	08551-2271
	15	Washer, flat No. 10	3050-0002
	16	Ring, retainer, grip 3/16	0510-0053
	17	Screw, BH 2-56 x 3/16	0520-0024
	18	Spring, dial	1460-0196
	19	Axle, dial	08551-2269
	20	Bushing, bronze 1/4 lg	1410-0088
	21	Pulley, dial	08551-2270
	22	Pin, dowel 0.125 dia 1/2 lg	1480-0017
	23	Bracket	08551-0100
	24	Frequency Scale drum assy	08551-4002
	25	Screw, BH 8-32 x 3/8 w/lockwash	2550-0007
A11S1	26	Switch Assy, FREQUENCY(GC)	08551-6170
	27	Plate, switch (FREQUENCY(GC))	08551-0101
	28	Washer, lock 3/8 internal teeth	2190-0016
	29	Nut, hex 3/8-32	2950-0001
	30	Setscrew, 8-32 x 1/8	3030-0005
	31	Block, drive	08551-2262
	32	Ring, retainer 1-1/16	0510-0065
	33	Pulley, switch (FREQUENCY(GC))	08551-2292
	34	Screw, RH 4-40 x 1/8	2200-0001
	35	Pulley	00692-266
	36	Rivet	08551-2293
	37	Bracket, OSC TRACK BALANCE meter	08551-0045
	38	Screw, BH 6-32 x 5/16 w/lockwash	2390-0007
M1	39	Meter, OSC TRACK BALANCE	1120-0156
A24S1	40	Switch STABILIZATION	08551-6132
	41	Plate, switch (STABILIZATION)	08551-0101
	42	Screw, RH 4-40 x 1/2	2200-0009
	43	Lockwasher, #4 internal teeth	2190-0004
	44	Screw, BH 2-56 x 3/16	0520-0024
	45	Washer, flat No. 2	3050-0098
	46	Pointer	08551-2261
	47	Spring, pointer	08551-2298
	48	Screw, RH 2-56 x 1/8	0520-0025
	49	Setscrew, 6-32 x 1/8	3030-0145
	50	Collar, brake	08551-2265
	51	Spacer, panel	08551-2263
	52	Screw, FH 6-32 x 1/4	2380-0001
	53	Cable, brake	08551-2266
	54	Carriage, cursor	08551-2260
	55	Ring, retainer 1/4	0510-0005
	56	Shaft, switch gear	08551-2291
	57	Gear, switch	08551-2273
	58	Spacer, No. 6 8 x 3/8	0380-0006
	59	Washer, flat 1/4ID x 3/4OD	3050-0074
	60	Plate, gear box front	08551-2251
	61	Screw, BH 6-32 x 3/8 w/lockwash	2390-0009
	62	Support, drum	08551-2256
	63	Locating shaft	08551-2296
	64	Nut, hex 1/4-28	2950-0036
	65	Spacer, gear box	08551-2253

Ref Desig	In
S4	
R7	
R6	
R5	

Figure 6-8

DIAL DRIVE ASSEMBLY, COMPONENT IDENTIFICATION

Ref Desig	Index No.	Description	hp Stock No.
	1	Screw, RH 8-32 x 1-1/4	2520-0011
	2	Lockwasher, No. 8 internal teeth	2190-0009
	3	Washer, flat 1/4ID x 3/8OD	3050-0017
	4	Support, pulley	08551-2258
	5	Support, dial	08551-2257
	6	Mask, drum	08551-0016
	7	Screw, RH 4-40 x 1/4 w/lockwash	2200-0004
	8	Subpanel	08551-2250
	9	Screw, BH 8-32 x 3/8 w/lockwash	2550-0007
	10	Ring, retainer, grip 3/16	0510-0053
	11	Shaft, pulley	08551-2272
	12	Pulley	00692-266
	13	Pulley-Delrin	08551-2249
	14	Axle, pulley	08551-2271
	15	Washer, flat No. 10	3050-0002
	16	Ring, retainer, grip 3/16	0510-0053
	17	Screw, BH 2-56 x 3/16	0520-0024
	18	Spring, dial	1460-0196
	19	Axle, dial	08551-2269
	20	Bushing, bronze 1/4 lg	1410-0088
	21	Pulley, dial	08551-2270
	22	Pin, dowel 0.125 dia 1/2 lg	1480-0017
	23	Bracket	08551-0100
	24	Frequency Scale drum assy	08551-4002
	25	Screw, BH 8-32 x 3/8 w/lockwash	2550-0007
A11S1	26	Switch Assy, FREQUENCY(GC)	08551-6170
	27	Plate, switch (FREQUENCY(GC))	08551-0101
	28	Washer, lock 3/8 internal teeth	2190-0016
	29	Nut, hex 3/8-32	2950-0001
	30	Setscrew, 8-32 x 1/8	3030-0005
	31	Block, drive	08551-2262
	32	Ring, retainer 1-1/16	0510-0065
	33	Pulley, switch (FREQUENCY(GC))	08551-2292
	34	Screw, RH 4-40 x 1/8	2200-0001
	35	Pulley	00692-266
	36	Rivet	08551-2293
	37	Bracket, OSC TRACK BALANCE meter	08551-0045
	38	Screw, BH 6-32 x 5/16 w/lockwash	2390-0007
M1	39	Meter, OSC TRACK BALANCE	1120-0156
A24S1	40	Switch STABILIZATION	08551-6132
	41	Plate, switch (STABILIZATION)	08551-0101
	42	Screw, RH 4-40 x 1/2	2200-0009
	43	Lockwasher, #4 internal teeth	2190-0004
	44	Screw, BH 2-56 x 3/16	0520-0024
	45	Washer, flat No. 2	3050-0098
	46	Pointer	08551-2261
	47	Spring, pointer	08551-2298
	48	Screw, RH 2-56 x 1/8	0520-0025
	49	Setscrew, 6-32 x 1/8	3030-0145
	50	Collar, brake	08551-2265
	51	Spacer, panel	08551-2263
	52	Screw, FH 6-32 x 1/4	2380-0001
	53	Cable, brake	08551-2266
	54	Carriage, cursor	08551-2260
	55	Ring, retainer 1/4	0510-0005
	56	Shaft, switch gear	08551-2291
	57	Gear, switch	08551-2273
	58	Spacer, No. 6 8 x 3/8	0380-0006
	59	Washer, flat 1/4ID x 3/4OD	3050-0074
	60	Plate, gear box front	08551-2251
	61	Screw, BH 6-32 x 3/8 w/lockwash	2390-0009
	62	Support, drum	08551-2256
	63	Locating shaft	08551-2296
	64	Nut, hex 1/4-28	2950-0036
	65	Spacer, gear box	08551-2253

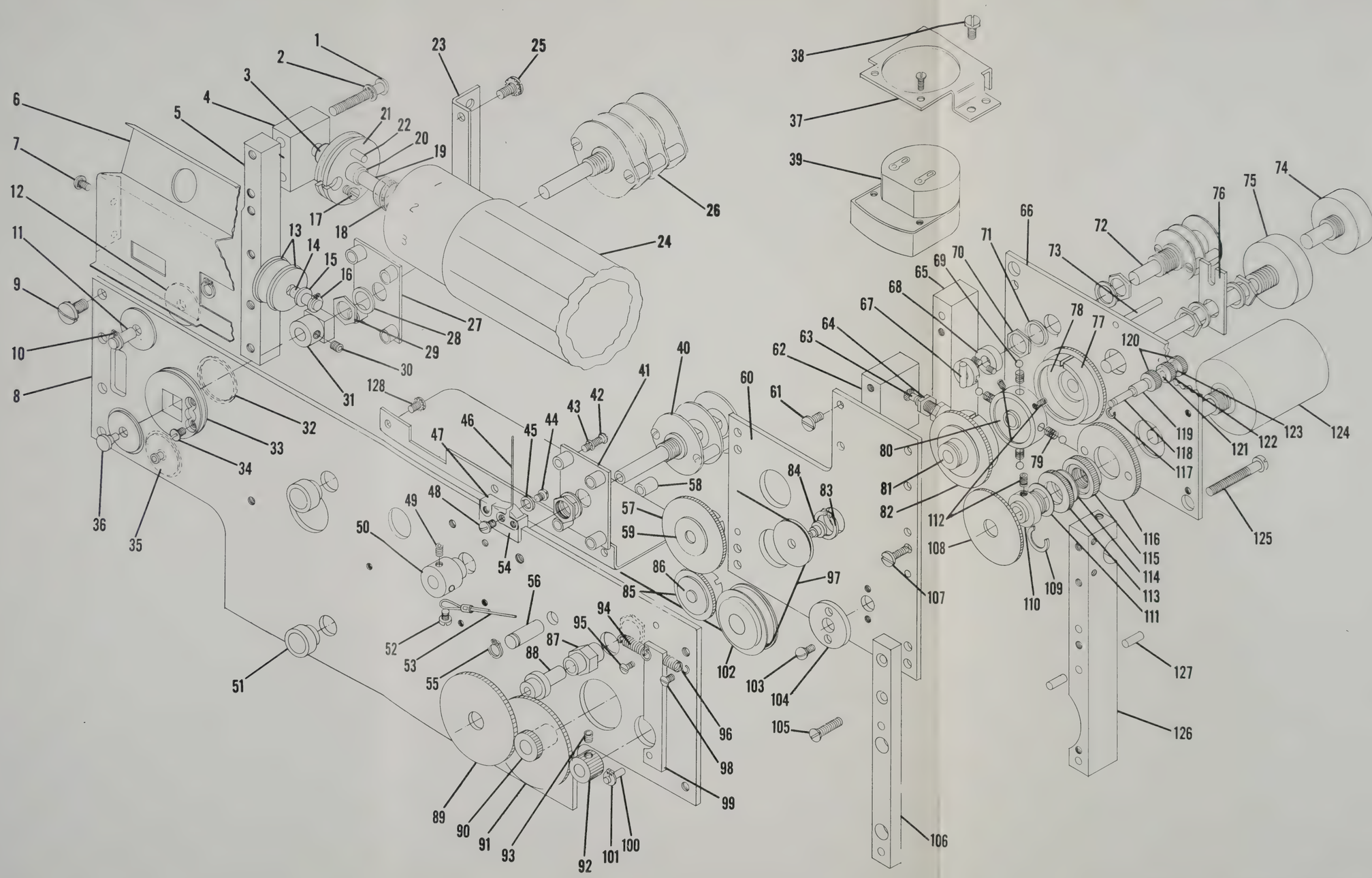


Figure 6-8. Dial Drive Assembly, Component Identification

Prefix designations in the Table with A9

Table 6-2. Reference Designation Index, Converter Assy A9

Reference Designation	Stock No.	Description #	Note
		PREFIX THE FOLLOWING PARTS A9	
	08551-6031	CONVERTER ASSY	
A1	08551-6120	AMPLIFIER BOARD ASSY: 200 MC	
A1C1	0150-0069	C:FXD CER 1000 PF +100-20% 500VDCW	
A1C2	0150-0069	C:FXD CER 1000 PF +100-20% 500VDCW	
A1C3	0150-0069	C:FXD CER 1000 PF +100-20% 500VDCW	
A1C4	0150-0031	C:FXD TI 2PF 5% 500VDCW	
A1L1	9140-0159	COIL:FXD 0.47UH 20%	
A1L2	9140-0143	COIL:FXD RF 3.3 UH	
A1L3	9140-0143	COIL:RF FXD 3.3UH 10%	
A1L4	9100-0320	COIL:VAR 200MC AMPL OUTPUT ADJ	
A1L5	9140-0159	COIL:FXD 0.47UH 20%	
A1R1	0683-4705	R:FXD COMP 47 OHM 5% 1/4W	
A1R2	0690-4721	R:FXD COMP 4700 OHM 10% 1W	
A1TB1	08551-2211	BOARD:200 MC AMPLIFIER PC	
A1V1	1921-0026	ELECTRON TUBE:8058 NUVISTOR TRIODE	
	08551-0027	BRACKET, TUBE MTG.	
A1XV1	1200-0114	SOCKET:ELECTRON TUBE NUVISTOR MICA	
A2	08551-6119	MIXER ASSY: 200-20 MC	
A2C1	0150-0093	C:FXD CER 0.01UF +80-20% 100VDCW	
A2C2	0150-0088	C:FXD CER 3.9PF-0.025PF 500VDCW	
A2C3	0150-0046	C:FXD TI 0.68 PF 5% 500 VDCW	
A2C4	0150-0087	C:FXD CER 62PF 10% 500VDCW	
A2C5	0160-0186	C:FXD MICA 10.7PF 1% 300VDCW 20MC OUTPUT ADJ	
A2C6	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A2L1	9100-0319	COIL:VAR 0.08-0.1 UH	
A2L2	9100-0321	COIL:VAR 3-6 UH	
A2L3	9140-0146	COIL:RF FIXED 10UH 10%	
A2L4	9140-0095	COIL:RF FXD 0.27UH 10%	
A2R1	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A2R2	0683-5115	R:FXD COMP 510 OHM 5% 1/4W	
A2TB1	08551-2210	BOARD:200 MC MIXER PC	
A2V1	1921-0013	ELECTRON TUBE:6CW4	
A2XV1	1200-0086	SOCKET:NUVISTOR 5-PIN	
A3	08551-6051	180MC OSCILLATOR BOARD ASSY.	
A3C1	0150-0051	C:FXD CER 100 PF 600 VDCW	
A3C2	0150-0051	C:FXD CER 100 PF 600 VDCW	
A3C3	0150-0029	C:FXD TI 1PF 10% 500VDCW	
A3C4	0150-0051	C:FXD CER 100 PF 600 VDCW	
A3C5	0150-0116	C:FXD CER 47PF 10% 500VDCW	
A3C6	0150-0100	C:FXD CER 13 PF 2% 500 VDCW	
A3C7	0121-0033	C:VAR AIR 1.4-7.3PF 180MC OSC FREQ ADJ	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index, Converter Assy A9 (Cont.)

Reference Designation	Stock No.	Description #	Note
A3C8	0160-0386	C:FXD CER 3.3PF +/-0.25PF 500VDCW	
A3C9	0150-0051	C:FXD CER 100 PF 600 VDCW	
A3C10	0150-0051	C:FXD CER 100 PF 600 VDCW	
A3C11	0150-0051	C:FXD CER 100 PF 600 VDCW	
A3CR1	0122-0008	CAPACITOR:VOLTAGE VARIABLE 47PF AT -4V	
A3L1 THRU A3L2		NOT ASSIGNED	
A3L3	9140-0100	COIL:FXD RF 4.7 UH	
A3R1	0684-1211	R:FXD COMP 120 OHM 10% 1/4W	
A3R2	0687-2221	R:FXD COMP 2200 OHM 10% 1/2W	
A3R3	0687-4721	R:FXD COMP 4700 OHM 10% 1/2W	
A3R4	0721-0011	R:FXD DEPC 500K OHM 1% 1/8W	
A3R5	0684-1211	R:FXD COMP 120 OHM 10% 1/4W	
A3T1	08551-6111	TRANSFORMER:COUPLING	
A3TB1	08551-2185	BOARD:180MC OSCILLATOR BARE PC BD	
A3V1	1921-0041	ELECTRON TUBE:NUVISTOR TRIODE 7895	
A3XV1	1200-0086	SOCKET:NUVISTOR 5-PIN	
A4	08551-6183	180MC BUFFER AMPLIFIER ASSY.	
A4C1	0140-0176	C:FXD MICA 100 PF 2% 300VDCW	
A4C2	0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	
A4C3	0121-0127	C:VAR AIR 1.7-14.1PF 180MC AMPLITUDE ADJ	
A4C4	0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	
A4C5	0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	
A4C6	0160-2259	C:FXD CER 12 PF 5% 500VDCW	
A4C7	0121-0127	C:VAR AIR 1.7-14.1PF 1800MC OUTPUT ADJ	
A4C8	0160-2236	C:FXD CER 1 PF 500VDCW	
A4C9	0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	
A4C10	0160-2204	C:FXD MICA 100 PF 5% 300VDCW	
A4C11	0160-2244	C:FXD CER 3.0 PF ±0.25 PF 500VDCW (FACTORY SELECTED)	
A4L1	9140-0100	COIL:FXD RF 4.7 UH	
A4R1	0684-1211	R:FXD COMP 120 OHM 10% 1/4W	
A4R2	2100-0090	R:VAR COMP 2000 OHM 30% LIN 1/3W 1800MC OUTPUT ADJ	
A4T1	08551-6112	TRANSFORMER:COUPLING	
A4TB1	08551-2366	BOARD:180MC BUFF AMPLIFIER, BARE PC BD	
A4V1	1921-0013	ELECTRON TUBE:6CW4	
A4XV1	1200-0086	SOCKET:NUVISTOR 5-PIN	
C1	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C2	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C3	0150-0020	C:FXD CER 1500PF 20%	
C4	0150-0020	C:FXD CER 1500PF 20%	
C5	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index, Converter Assy A9 (Cont.)

Reference Designation	Stock No.	Description #	Note
C6		NOT ASSIGNED	
C7	0150-0011	C:FXD TI 1.5PF 20% 500VDCW	
C8		NOT ASSIGNED	
C9	0150-0011	C:FXD TI 1.5PF 20% 500VDCW	
C10		NOT ASSIGNED	
C11	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C12	0150-0020	C:FXD CER 1500PF 20%	
C13	0150-0020	C:FXD CER 1500PF 20%	
C14	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C15	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C16	0150-0020	C:FXD CER 1500PF 20%	
C17	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C18 THRU			
C20		NOT ASSIGNED	
C21	0150-0020	C:FXD CER 1500PF 20%	
C22	0150-0020	C:FXD CER 1500PF 20%	
C23	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C24	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C25	0150-0020	C:FXD CER 1500PF 20%	
C26	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C27	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C28	0150-0020	C:FXD CER 1500PF 20%	
C29	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C30	0150-0020	C:FXD CER 1500PF 20%	
FL1	08551-6124	FILTER ASSY:LOW-PASS	
L1	9140-0111	COIL:FXD RF 3.3UH	
L2	9140-0111	COIL:FXD RF 3.3UH	
L3	9140-0111	COIL:FXD RF 3.3UH	
L4	9140-0146	COIL:FXD RF 10.0 UH	
L5	08551-8006	COIL:200MC	
L6	08551-8006	COIL:200MC	
L7	08551-8006	COIL:200MC	
L8	9140-0100	COIL:FXD RF 4.7 UH	
L9	9140-0100	COIL:FXD RF 4.7 UH	
L10	9140-0100	COIL:FXD RF 4.7 UH	
L11	9140-0100	COIL:FXD RF 4.7 UH	
L12	9140-0100	COIL:FXD RF 4.7 UH	
L13		NOT ASSIGNED	
L14	9140-0111	COIL:FXD RF 3.3UH	
L15	9140-0111	COIL:FXD RF 3.3UH	
L16	9140-0111	COIL:FXD RF 3.3UH	
L17	9140-0100	COIL:FXD RF 4.7 UH	
L18	9140-0111	COIL:FXD RF 3.3UH	
R1 THRU			
R2		NOT ASSIGNED	
R3	0690-2221	R:FXD COMP 2200 OHM 10% 1W	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index, Converter Assy A9 (Cont.)

Reference Designation	Stock No.	Description #	Note
		MISCELLANEOUS	
	08551-0125	GASKET:RFI	
		FITS BETWEEN CONVERTER TOP & CASTING	
	08551-0124	TOP:CONVERTER	
		ATTACHING PARTS:	
	2200-0005	SCREW:MACHINE 4-40 X 5/16	
	2190-0004	WASHER:LOCK INT TOOTH 4-40	
	08551-2364	CASTING:CONVERTER	
	08551-0020	BOTTOM:CONVERTER	
		ATTACHING PARTS:	
	2200-0003	SCREW:MACHINE RH SST 4-40 X 1/4	
	2190-0004	WASHER:LOCK INT TOOTH 4-40	
	08551-0074	BRACKET:CONVERTER	

 # See list of abbreviations in introduction to this section

Prefix designations in this Table with A15

Table 6-3. Reference Designation Index, Lock Assy A15

Reference Designation	Stock No.	Description #	Note
		PREFIX THE FOLLOWING PARTS A15	
	08551-6100	LOCK ASSEMBLY	
A1	08551-6121	BOARD ASSY:10MC OSC/DISC	
A1C1	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A1C2	0121-0116	C:VAR AIR 2.2-17PF OSC FREQ ADJ	
A1C3	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A1C4	0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	
A1C5	0140-0151	C:FXD MICA 820PF 2% 300VDCW	
A1C6	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A1C7	0140-0228	C:FXD MICA 360PF 1% 300VDCW	
A1C8	0140-0197	C:FXD MICA 180 PF 5% 300VDCW	
A1C9	0121-0046	C:VAR CER 9-35PF 10MC AMPL INPUT LEVEL	
A1C10	0160-0186	C:FXD MICA 10.7PF 1% 300VDCW FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A1C11		NOT ASSIGNED	
A1C12	0140-0220	C:FXD MICA 200PF 1% 300VDCW	
A1C13		NOT ASSIGNED	
A1C14	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A1C15	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C16	0121-0116	C:VAR AIR 2.2-17 PF DISC. PRI ADJ	
A1C17	0150-0052	C:FXD CER 0.05 UF 20% 400VDCW	
A1C18	0150-0032	C:FXD CER 10 PF N150 500VDCW	
A1C19	0160-0332	C:FXD MICA 133 PF 1%	
A1C20	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A1C21	0121-0033	C:VAR AIR 1.4-7.3 PF DISC. SEC ADJ	
A1C22	0160-0906	C:FXD MICA 6.8 PF 1% 300 VDCW	
A1C23	0160-0368	C:FXD MICA 16PF 5%	
A1C24	0160-0182	C:FXD MICA 47PF 5% 300VDCW	
A1C25	0160-0906	C:FXD MICA 6.8 PF 1% 300 VDCW	
A1C26	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C27	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
A1C28 THRU			
A1C29		NOT ASSIGNED	
A1C30	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
A1C31	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
A1C32	0150-0052	C:FXD CER 0.05 UF 20% 400VDCW	
A1CR1	0122-0008	CAPACITOR:VOLTAGE VARIABLE 47PF AT -4V	
A1CR2	1901-0196	DIODE:SILICON	
A1CR3	1901-0196	DIODE:SILICON	
A1L1	08551-8010	COIL:2.2 UH	
A1L2		NOT ASSIGNED	
A1L3	08551-8011	COIL:DISC. PRI	
A1L4	08551-8012	COIL:DISC. SEC.	
A1Q1	1854-0005	TRANSISTOR:SILICON NPN 2N708	
A1R1	0683-3335	R:FXD COMP 33K OHM 5% 1/4W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	

See list of abbreviations in introduction to this section

Table 6-3. Reference Designation Index, Lock Assy A15 (Cont.)

Reference Designation	Stock No.	Description #	Note
A1R2	0683-5615	R:FXD COMP 560 OHM 5% 1/4W	
A1R3	0758-0073	R:FXD MET FLM 24K OHM 5% 1/2W	
A1R4	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A1R5	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A1R6	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A1R7	0683-1515	R:FXD COMP 150 OHM 5% 1/4W	
A1R8	0683-3305	R:FXD COMP 33 OHM 5% 1/4W	
A1R9	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
A1R10	0683-3305	R:FXD COMP 33 OHM 5% 1/4W	
A1R11	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A1R12	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
A1R13	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
A1R14	0684-6811	R:FXD COMP 680 OHM 10% 1/4W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A1R15	0727-0023	R:FXD DEPC 50 OHM 1% 1/2W	
A1T1	9100-0324	TRANSFORMER:VAR OUTPUT 10 MC AMPL OUTPUT TUNING	
A1TB1	08551-2212	BARE PRINTED CIRCUIT BOARD	
A1V1	1921-0015	ELECTRON TUBE: 8056 NUVISTOR TRIODE	
A1V2	1921-0013	ELECTRON TUBE:6CW4 NUVISTOR TRIODE	
A1XV1	1200-0086	SOCKET:NUVISTOR 5-PIN	
A1XV2	1200-0086	SOCKET:NUVISTOR 5-PIN	
A2 THRU A3		NOT ASSIGNED	
A4	08551-6104	BOARD ASSY.:PULSE AMPL	
A4C1	0150-0014	C:FXD CER 5000PF MIN 500VDCW	
A4C2	0140-0176	C:FXD MICA 100 PF 2% 300VDCW	
A4C3	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A4C4	0150-0121	C:FXD CER 0.1UF 50 VDCW	
A4C5	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C6	0150-0086	C:FXD CER 4700 PF 20% 500 VDCW	
A4C7	0140-0209	C:FXD MICA 5PF 10% 500VDCW	
A4C8	0140-0234	C:FXD MICA 500PF 1% 300VDCW	
A4C9	0150-0121	C:FXD CER 0.1UF 50 VDCW	
A4C10	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C11	0140-0234	C:FXD MICA 500PF 1% 300VDCW	
A4C12	0150-0072	C:FXD CER 200 PF 5% 500 VDCW	
A4C13	0150-0086	C:FXD CER 4700 PF 20% 500 VDCW	
A4C14	0160-0186	C:FXD MICA 10.7PF 1% 300VDCW	
A4C15	0140-0234	C:FXD MICA 500PF 1% 300VDCW	
A4C16	0160-0182	C:FXD MICA 47 PF 5% 300VDCW	
A4C17	0140-0208	C:FXD MICA 680PF 5% 300VDCW	
A4C18	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C19	0150-0121	C:FXD CER 0.1UF 50 VDCW	
A4C20	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C21	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A4C22	0160-0168	C:FXD MYLAR 0.1UF 10%	
A4C23	0160-0159	C:FXD MYLAR 6800PF 10%	

 # See list of abbreviations in introduction to this section

Table 6-3. Reference Designation Index, Lock Assy A15 (Cont.)

Reference Designation	Stock No.	Description #	Note
A4C24	0140-0219	C:FXD MICA 180PF 2% 300VDCW	
A4C25	0150-0122	C:FXD CER 2000PF 20% 500VDCW	
A4C26	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C27	0140-0215	C:FXD MICA 80 PF 5% 300VDCW	
A4C28	0130-0017	C:VAR CER 8-50 PF N750 20MC FLT ADJ	
A4C29	0130-0017	C:VAR CER 8-50 PF N750 10MC FLT ADJ	
A4CR1	1902-0057	DIODE:BREAKDOWN 6.49 5% 400MW	
A4CR2	1901-0040	SEMICON DEVICE:DIODE SILICON	
A4CR3	1902-0009	DIODE:BREAKDOWN 7.50 V 10%	
A4L1	9140-0155	COIL:FXD RF 28 UH	
A4L2	9140-0114	COIL:FXD RF 10 UH	
A4L3	08551-8015	COIL: P/O 10MC FILTER	
A4L4	9140-0121	COIL:FXD 1.8 UH	
A4L5	08551-8016	COIL: P/O 20MC FILTER	
A4L6	9140-0179	COIL-FXD R.F. 22 UH 10% 275 MA	
A4Q1	1854-0073	TRANSITOR:NPN SILICON 2N3478	
A4Q2	1854-0251	TRANSISTOR:SILICON NPN	
A4Q3	1854-0251	TRANSISTOR:SILICON NPN	
A4Q4	1854-0251	TRANSISTOR:SILICON NPN	
A4Q5	1854-0251	TRANSISTOR:SILICON NPN	
A4Q6	1854-0251	TRANSISTOR:SILICON NPN	
A4Q7	1853-0001	TRANSISTOR:PNP SILICON 30V 900MW	
A4R1	0757-0159	R:FXD MET FLM 1000 OHM 1% 1/2W	
A4R2	0698-3401	R:FXD MET FLM 215 OHM 1% 1/2W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A4R3	0727-0122	R:FXD DEPC 2.51K OHM 1% 1/2W	
A4R4	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A4R5	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A4R6	0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	
A4R7	0727-0362	R:FXD DEPC 3673 OHM 1/2% 1/2W	
A4R8	0727-0361	R:FXD DEPC 2802 OHM 1/2% 1/2W	
A4R9	0758-0015	R:FXD MET FLM 220 OHM 5% 1/2W	
A4R10	0683-4705	R:FXD COMP 47 OHM 5% 1/4W	
A4R11	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A4R12	0727-0398	R:FXD DEPC 3.79K OHM 1/2% 1/2W	
A4R13	0724-0030	R:FXD DEPC 9090 OHM 1% 1/4W	
A4R14	0727-0100	R:FXD DEPC 1000 OHM 1% 1/2W	
A4R15	0727-0109	R:FXD DEPC 1470 OHM 1% 1/2W	
A4R16	0727-0122	R:FXD DEPC 2.51K OHM 1% 1/2W	
A4R17	0683-3915	R:FXD COMP 390 OHM 5% 1/4W	
A4R18	0683-4705	R:FXD COMP 47 OHM 5% 1/4W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A4R19	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A4R20	0727-0109	R:FXD DEPC 1470 OHM 1% 1/2W	

See list of abbreviations in introduction to this section

Table 6-3. Reference Designation Index, Lock Assy A15 (Cont.)

Reference Designation	Stock No.	Description #	Note
A4R21	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A4R22	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A4R23	0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	
A4R24	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A4R25	0727-0149	R:FXD DEPC 7.96K OHM 1% 1/2W	
A4R26	0727-0149	R:FXD DEPC 7.96K OHM 1% 1/2W	
A4R27	0727-0100	R:FXD DEPC 1000 OHM 1% 1/2W	
A4R28	0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	
A4R29	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A4R30	0683-2015	R:FXD COMP 200 OHM 5% 1/4W	
A4R31	0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	
A4R32	0683-9105	R:FXD COMP 91 OHM 5% 1/4W	
A4TB1	08551-2172	BOARD: PULSE AMPL: BARE PC BD	
C1	0150-0019	C:FXD CER 1000PF 20%	
C2	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C3	0150-0019	C:FXD CER 1000PF 20%	
C4	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C5	0150-0019	C:FXD CER 1000PF 20%	
C6	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C7	0150-0019	C:FXD CER 1000PF 20%	
C8	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C9	0150-0072	C:FXD CER 200 PF 5% 500 VDCW	
C10	0150-0019	C:FXD CER 1000PF 20%	
C11	0150-0019	C:FXD CER 1000PF 20%	
C12	0150-0019	C:FXD CER 1000PF 20%	
C13	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
C14	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
C15	0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	
C16	0150-0070	C:FXD CER 0.02 UF 20% 500VDCW	
C17	0131-0004	C:VAR MICA 16-150 PF 175VDCW	
C18	0150-0005	C:FXD CER 1000 PF 25% 500VDCW	
C19	0160-0182	C:FXD MICA 47PF 5% 300VDCW	
L1	9140-0136	COIL:FXD RF 22 UH	
L2	9140-0115	COIL:RF FXD 22UH 10%	
L3	9140-0115	COIL:RF FXD 22UH 10%	
L4	9140-0115	COIL:RF FXD 22UH 10%	
L5	9140-0115	COIL:RF FXD 22UH 10%	
L6	9140-0098	COIL:FXD RF 2.2 UH	
R1	0687-1025	R:FXD COMP 1000 OHM 5% 1/2W	
R2	0687-2221	R:FXD COMP 2200 OHM 10% 1/2W	
TP1	1250-0212	CONNECTOR:JACK CHASSIS BNC DISC OUTPUT	
TP2	1250-0731	CONNECTOR:RF BNC BULKHEAD MOUNT PULSE AMP OUTPUT	

 # See list of abbreviations in introduction to this section

Table 6-3. Reference Designation Index, Lock Assy A15 (Cont.)

Reference Designation	Stock No.	Description #	Note
		MISCELLANEOUS	
	08551-0073	GASKET:RFI LOCK ASSY CASTING TOP COVER	
	08551-0067	GASKET-RFI: BOTTOM OF LOCK ASSY	
	08551-0032	PLATE:SHOCK MOUNT	
	08551-0026	SHIELD:DISCRIMINATOR	
	6960-0006	PLUG BUTTON:ST NP FOR 1/4 INCH HOLE	

See list of abbreviations in introduction to this section

Table 6-4 Replaceable Parts

℗ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0121-0033	C:VAR AIR 1.4-7.3PF	74970	U 189 3	2
0121-0046	C:VAR CER 9-35PF	28480	0121-0046	1
0121-0116	C:VAR AIR 2.2-17PF	79970	189-8-5	2
0121-0127	C:VAR AIR 1.7-14.1 PF	28480	0121-0127	2
0122-0008	C:VOLTAGE VAR 47 PF AT -4V	01281	PC114	2
0130-0017	C:VAR CER 8-50 UF N750	28480	0130-0017	2
0131-0004	C:VAR MICA 16-150 PF 175VDCW	28480	0131-0004	1
0140-0069	C:FXD MICA 550 PF 10% 500 VDCW	00853	TYPE M 100 E10	1
0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	04062	DM15C220J	1
0140-0151	C:FXD MICA 820PF 2% 300VDCW	04062	DM15F821G	1
0140-0152	C:FXD MICA 1000PF 5% 300VDCW	04062	DM16F102J	1
0140-0159	C:FXD MICA 3000PF 300VDCW	04062	DM19F302G	3
0140-0172	C:FXD MICA 3000 PF 1% 100VDCW	72136	DM19F302F 100V	1
0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	04062	RDM15F101G3C	6
0140-0180	C:FXD MICA 2000 PF 2% 300 VDCW	04062	DM19F202G (300V)	1
0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	04062	DM15E560J 300V	1
0140-0196	C:FXD MICA 150 PF 5% 300 VDCW	04062	DM15F151J 300V	1
0140-0197	C:FXD MICA 180 PF 5% 300VDCW	28480	0140-0197	1
0140-0200	C:FXD MICA 390PF 5% 300VDCW	04062	DM15F391J 300V	1
0140-0208	C:FXD MICA 680PF 5% 300VDCW	04062	DM15F681J	1
0140-0209	C:FXD MICA 5PF 10% 500VDCW	04062	DM15C050K 500V	1
0140-0213	C:FXD MICA 2000PF 1% 300VDCW	04062	DM19F202F 300VDC	1
0140-0215	C:FXD MICA 80 PF 5% 300VDCW	04062	DM15E800G 300V	1
0140-0219	C:FXD MICA 180PF 2% 300VDCW	04062	RDM15F181G3C	1
0140-0220	C:FXD MICA 200PF 1% 300VDCW	04062	DM15F201F 300V	1
0140-0228	C:FXD MICA 360PF 1% 300VDCW	04062	RDM15F361F3C	1
0140-0234	C:FXD MICA 500PF 1% 300VDCW	04062	DM15F501F 300V	3
0150-0005	C:FXD CER 1000 PF 25% 500VDCW	04222	TYPE CFS-1	17
0150-0011	C:FXD TI 1.5PF 20% 500VDCW	78488	TYPE GA	2
0150-0014	C:FXD CER 5000PF MIN 500VDCW	04222	D1 4	1
0150-0019	C:FXD CER 1000PF 20%	72982	327005X5U0102M	7
0150-0020	C:FXD CER 1500PF 20%	72982	326 001 X5U0 152M	10
0150-0023	C:FXD CER 2000 PF 20% 1000VDCW	01281	TYPE 126	1
0150-0024	C:FXD CER 0.02UF +80%-20% 600VDCW	71590	DD203	1
0150-0029	C:FXD TI 1PF 10% 500VDCW	78488	GA1.0PF	1
0150-0031	C:FXD TI 2PF 5% 500VDCW	78488	TYPE GA 2PF 5%	1
0150-0032	C:FXD CER 10 PF N150 500VDCW	72982	315-000 U2J0 100F	1
0150-0036	C:FXD CER 470 PF 20% 6KV	91418	#6KV470 20%	1
0150-0046	C:FXD TI 0.68 PF 5% 500 VDCW	78488	TYPE GA	1
0150-0049	C:FXD CER 100 PF 5% 4KV	91418	#KV100 N1500 5%	1
0150-0050	C:FXD CER 1000PF 600 VDCW	18486	TYPE E	3
0150-0051	C:FXD CER 100 PF 600 VDCW	18486	TYPE E	6
0150-0052	C:FXD CER 0.05 UF 20% 400VDCW	56289	33C17A	6
0150-0069	C:FXD CER 1000 PF +100-20% 500VDCW	72982	801-010X5G0102Z	3
0150-0070	C:FXD CER 0.02 UF 20% 500VDCW	72982	821-011X5U0203M	1
0150-0072	C:FXD CER 200 PF 5% 500 VDCW	56289	40C FORMULATION 28	2
0150-0079	C:FXD CER 3300 PF 10% 500 VDCW	72982	#811 000 Y5F0332K	1
0150-0086	C:FXD CER 4700 PF 20% 500 VDCW	56289	CK2AW472M	2
0150-0087	C:FXD CER 62PF 10% 500VDCW	91418	SM-62-N1500 10%	1

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	
0150-0088	C:FXD CER 3.9PF-0.025PF 500VDCW	72982	301-011-COHO 399C	1	
0150-0093	C:FXD CER 0.01UF +80-20% 100VDCW	91418	TA	11	
0150-0096	C:FXD CER 0.05 UF +80-20% 100VDCW	91418	TYPE TA	6	
0150-0100	C:FXD CER 13 PF 2% 500 VDCW	95275	VY13C 130G A	1	
0150-0116	C:FXD CER 47PF 10% 500VDCW	71590	CC20 TCN 47	1	
0150-0121	C:FXD CER 0.1UF 50 VDCW	56289	5C50A	4	
0150-0122	C:FXD CER 2000PF 20% 500VDCW	72982	801 000 Y5S 202M	1	
0160-0002	C:FXD MY .01UF 10% 600VDCW	56289	160P10396	4	
0160-0056	C:FXD PAPER 0.047 UF 10% 1000VDCW	72354	73P473910	2	
0160-0134	C:FXD MICA 220 PF 5% 300VDCW	14655	RDM15F221J3C	1	
0160-0151	C:FXD CER 4700 PF +80-20% 4000VDCW	71590	DA172-097C	1	
0160-0156	C:FXD MY 0.0039 UF 10% 200VDCW	28480	0160-0156	1	
0160-0159	C:FXD MY 6800 UF 10%	28480	0160-0159	1	
0160-0161	C:FXD MY 0.01 UF 10% 200VDCW	28480	0160-0161	1	
0160-0163	C:FXD MY 3300 PF 5%	28480	0160-0163	4	
0160-0168	C:FXD MY 0.1 UF 10%	28480	0160-0168	3	
0160-0179	C:FXD MICA 33 PF 5% 300VDCW	04062	DM15E330J	1	
0160-0182	C:FXD MICA 47 PF 5% 300VDCW	14655	CD15E470J	4	
0160-0186	C:FXD MICA 10.7 PF 1% 300VDCW	04062	RDM15C(10.7PF)	3	
0160-0194	C:FXD MY 0.015 UF 10%	28480	0160-0194	1	
0160-0332	C:FXD MICA 133 PF 1%	04062	RDM15F133F3C	1	
0160-0368	C:FXD MICA 15 PF 5%	28480	0160-0368	1	
0160-0386	C:FXD CER 3.3±0.25 PF 500VDCW	72982	301-N330-85C	1	
0160-0845	C:FXD MY 0.22 UF 10% 400VDCW	01281	HEW 29	3	
0160-0906	C:FXD MICA 6.8 PF 1%.300VDCW	72982	101-U2J-689C	2	
0160-2044	C:FXD PAPER 0.1 UF 10% 2000VDCW	82047	28F1505	1	
0160-2045	BRACKET:CAPACITOR	82047	302C919G14	1	
0160-2204	C:FXD MICA 100 PF 5% 300VDCW	28480	0160-2204	1	
0160-2236	C:FXD CER 1 PF 500VDCW	72982	301-000-COKO-109C	1	
0160-2244	C:FXD CER 3.0±0.25 PF 500VDCW	72982	301-NPO-3.0PF	1	
0160-2259	C:FXD CER 12 PF 5% 500VDCW	28480	0160-2259	1	
0160-2357	C:FXD CER FEED THRU 1000 PF +80-20%	28480	0160-2357	1	
0160-3018	C:FXD PAPER 3 UF +20-10% 2000VDCW	56289	P49901-OSD	2	
0170-0022	C:FXD MY 0.1 UF 20% 600VDCW	09134	TYPE 27	3	
0170-0040	C:FXD MY .047 UF 10% 200VDCW	56289	192P47392	2	
0170-0060	C:FXD MY 0.047UF 10% 400VDCW	84411	TYPE 663 UW	1	
0170-0084	C:FXD MY 0.068UF 20% 50VDCW	84411	601PE STYLE 3	1	
0170-0086	C:FXD MY 0.22 UF 20% 50VDCW	84411	601-PE STYLE 3	1	
0180-0032	C:FXD ELECT 10UF 10VDCW	56289	30D147A1	1	
0180-0042	C:FXD ELECT 120UF 350VDCW	56289	D32353	3	
0180-0052	C:FXD ELECT 2X10UF 450VDCW	56289	DEW D27990	1	
0180-0061	C:FXD ELECT 100UF +100%-10% 15VDCW	56289	30D172A1	1	
0180-0063	C:FXD ELECT 500UF -10%+100% 3VDCW	56289	30D32530	1	
0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	56289	30D106G150DF4	3	
0180-0098	C:FXD ELECT 100UF 20% 20VDCW	56289	150D107X0020S2	3	
0180-0104	C:FXD ELECT 200 UF 15VDCW	56289	30D174A1	1	
0180-0116	C:FXD ELECT TA 6.8UF 10% 35VDCW	56289	150D685X9035B2	1	
0180-0128	C:FXD ELECT 2800UF -10+30% 30VDCW	00853	505-1010-02	1	
0180-0136	C:FXD ELECT 10UF -10+100% 50VDCW	56289	40D193A2	1	
0180-0144	C:FXD ELECT 200UF -10+100% 25VDCW	56289	41D D31334	1	
0180-0155	C:FXD TA 2.2UF 20% 20VDCW	56289	150D225X0020AZ	1	
0180-0205	C:FXD ALUM. 12 UF -10 +75% 150VDCW	05571	30D126G150DH4	1	
0180-0217	C:FXD AL ELECT. 10UF 250VDCW	56289	34D	4	
0180-0269	C:FXD ELECT 1.0 UF +75-10% 150VDCW	56289	30D105F150BA2-DSM	1	
0360-0018	TERM. BOARD:4-INSULATED 1-GROUNDING	28480	0360-0018	2	

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0370-0025	KNOB:	28480	0370-0025	1
0370-0050	HANDLE:CRANK ONLY	28480	0270-0050	1
0370-0111	KNOB:CRANK 1-INCH DIAMETER 1/4 IN SHAFT	28480	0370-0111	1
0370-0112	KNOB:ATTENUATOR (DB)	28480	0370-0112	4
0370-0113	KNOB:	28480	0370-0113	2
0370-0114	KNOB:RED W/ARROW 5/8 IN. OD 1/8 IN.SHAFT	28480	0370-0114	2
0370-0306	KNOB:RED W/ARROW 5/8 IN. OD 1/8 IN.SHAFT	28480	0370-0306	1
0490-0039	RELAY:DPDT	77342	KA11AY-6.3	1
0490-0114	RELAY:ARMATURE SPDT/COIL 125MW SENSITIVITY	77342	KA 2577-1	1
0490-0115	RELAY:ARMATURE 3PDT/COIL 6VDC	77342	KA14DY	2
0490-0123	RELAY:ARMATURE SPDT 2-AMP/COIL 6VDC	77342	RS5D	2
0510-0219	RING:RETAINING 7/16 INCH DIA	89462	5103-43	1
0510-0222	RING:RETAINING GRIP STL CADMIUM PLATED	89462	5555-15MD	1
0570-0001	SCREW:KNURLED 1/4-20 BR NP	28480	0570-0001	2
0590-0053	NUT:CAPTIVE J-TYPE 6-32 X 0.125	78553	C17859-632-24D	14
0683-1005	R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005	1
0683-1015	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015	1
0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025	2
0683-1035	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035	2
0683-1045	R:FXD COMP 100K OHM 5% 1/4W	01121	CB 1045	4
0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225	3
0683-1315	R:FXD COMP 130 OHM 5% 1/4W	01121	CB 1315	1
0683-1515	R:FXD COMP 150 OHM 5% 1/4W	01121	CB 1515	1
0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525	1
0683-1545	R:FXD COMP 150K OHM 5% 1/4W	01121	CB 1545	2
0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825	1
0683-2015	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015	1
0683-2215	R:FXD COMP 220 OHM 5% 1/4W	01121	CB 2215	1
0683-2415	R:FXD COMP 240 OHM 5% 1/4W	01121	CB 2415	1
0683-3305	R:FXD COMP 33 OHM 5% 1/4W	01121	CB 3305	2
0683-3315	R:FXD COMP 330 OHM 5% 1/4W	01121	CB 3315	1
0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325	1
0683-3335	R:FXD COMP 33K OHM 5% 1/4W	01121	CB 3335	1
0683-3915	R:FXD COMP 390 OHM 5% 1/4W	01121	CB 3915	1
0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925	1
0683-4705	R:FXD COMP 47 OHM 5% 1/4W	01121	CB 4705	3
0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725	3
0683-4735	R:FXD COMP 47K OHM 5% 1/4W	01121	CB 4735	1
0683-5115	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115	1
0683-5615	R:FXD COMP 560 OHM 5% 1/4W	01121	CB 5615	1
0683-8215	R:FXD COMP 820 OHM 5% 1/4W	01121	CB 8215	1
0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	01121	CB 8225	1
0683-9105	R:FXD COMP 91 OHM 5% 1/4W	01121	CB 9105	1
0684-1211	R:FXD COMP 120 OHM 10% 1/4W	01121	CB 1211	3
0684-3331	R:FXD COMP 33K OHM 10% 1/4W	01121	CB 3331	4
0684-6811	R:FXD COMP 680 OHM 10% 1/4W	01121	CB 6811	1
0686-1005	R:FXD COMP 10 OHM 5% 1/2W	01121	EB 1005	3
0686-1025	R:FXD COMP 1000 OHM 5% 1/2W	01121	EB 1025	7
0686-2055	R:FXD COMP 2 MEGOHM 5% 1/2W	01121	EB2055	1
0686-2215	R:FXD COMP 220 OHM 5% 1/2W	01121	EB 2215	3

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0686-2445	R:FXD COMP 240K OHM 5% 1/2W	01121	EB 2445	1
0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	01121	EB 5625	3
0686-6825	R:FXD COMP 6800 OHM 5% 1/2W	01121	EB 6825	3
0687-1011	R:FXD COMP 100 OHM 10% 1/2W	01121	EB 1011	4
0687-1021	R:FXD COMP 1000 OHM 10% 1/2W	01121	EB 1021	4
0687-1025	R:FXD COMP 1000 OHM 5% 1/2W	01121	EB-1025	1
0687-1031	R:FXD COMP 10K OHM 10% 1/2W	01121	EB 1031	1
0687-1041	R:FXD COMP 100K OHM 10% 1/2W	01121	EB 1041	2
0687-1051	R:FXD COMP 1 MEGOHM 10% 1/2W	01121	EB 1051	2
0687-1221	R:FXD COMP 1200 OHM 10% 1/2W	01121	EB 1221	1
0687-1241	R:FXD COMP 120K OHM 10% 1/2W	01121	EB 1241	1
0687-2221	R:FXD COMP 2200 OHM 10% 1/2W	01121	EB 2221	3
0687-2741	R:FXD COMP 270K OHM 10% 1/2W	01121	EB 2741	1
0687-3301	R:FXD COMP 33 OHM 10% 1/2W	01121	EB 3301	2
0687-3311	R:FXD COMP 330 OHM 10% 1/2W	01121	EB 3311	1
0687-3321	R:FXD COMP 3300 OHM 10% 1/2W	01121	EB 3321	2
0687-3931	R:FXD COMP 39K OHM 10% 1/2W	01121	EB 3931	1
0687-4721	R:FXD COMP 4700 OHM 10% 1/2W	01121	EB 4721	2
0687-4741	R:FXD COMP 470K OHM 10% 1/2W	01121	EB 4741	1
0687-6831	R:FXD COMP 68K OHM 10% 1/2W	01121	EB 6831	2
0687-8211	R:FXD COMP 820 OHM 10% 1/2W	01121	EB 8211	1
0689-1505	R:FXD COMP 15 OHM 5% 1W	01121	GB 1505	1
0690-1011	R:FXD COMP 100 OHM 10% 1W	01121	GB 1001	1
0690-1021	R:FXD COMP 1000 OHM 10% 1W	01121	GB 1021	1
0690-1041	R:FXD COMP 100K OHM 10% 1W	01121	GB 1041	1
0690-1221	R:FXD COMP 1200 OHM 10% 1W	01121	GB 1221	1
0690-1231	R:FXD COMP 12K OHM 10% 1W	01121	GB 1231	2
0690-1541	R:FXD COMP 150K OHM 10% 1W	01121	GB 1541	3
0690-2221	R:FXD COMP 2200 OHM 10% 1W	01121	GB 2221	1
0690-2231	R:FXD COMP 22K OHM 10% 1W	01121	GB 2231	2
0690-3301	R:FXD COMP 33 OHM 10% 1W	01121	GB 3301	1
0690-4701	R:FXD COMP 47 OHM 10% 1W	01121	GB 4701	1
0690-4721	R:FXD COMP 4700 OHM 10% 1W	01121	GB 4721	1
0690-5621	R:FXD COMP 5600 OHM 10% 1W	01121	GB 5621	3
0690-6821	R:FXD COMP 6800 OHM 10% 1W	01121	GB 6821	3
0693-1011	R:FXD COMP 100 OHM 10% 2W	01121	HB 1011	1
0693-2221	R:FXD COMP 2200 OHM 10% 2W	01121	HB 2221	1
0693-2731	R:FXD COMP 27K OHM 10% 2W	01121	HB 2731	4
0693-3331	R:FXD COMP 33K OHM 10% 2W	01121	HB 3331	1
0693-4701	R:FXD COMP 47 OHM 10% 2W	01121	HB 4701	1
0698-3102	R:FXD MET FLM 237 OHM 1% 1/2W	28480	0698-3102	3
0698-3401	R:FXD MET FLM 215 OHM 1% 1/2W	28480	0698-3401	5
0698-3412	R:FXD MET FLM 3.83K OHM 1% 1/2W	28480	0698-3412	2
0698-3420	R:FXD MET FLM 34.8K OHM 1% 1/2W	28480	0698-3420	1
0698-3556	R:FXD MET FLM 16.4K OHM 1/2% 1/4W	28480	0698-3556	1
0698-5836	R:FXD MET FLM 1K OHM 1% 1/20W	28480	0698-5836	1
0699-0001	R:FXD COMP 2.7 OHM 10% 1/2W	01121	EB 27G1	1
0721-0011	R:FXD DEPC 500K OHM 1% 1/8W	28480	0721-0011	1
0724-0030	R:FXD DEPC 9090 OHM 1% 1/4W	28480	0727-0030	1
0727-0022	R:FXD DEPC 50 OHM 1% 1/2W	28480	0727-0022	1

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0727-0023	R:FXD DEPC 50 OHM 1% 1/2W	28480	0727-0023	1
0727-0074	R:FXD DEPC 436 OHM 1/2% 1/2W	28480	0727-0074	1
0727-0075	R:FXD DEPC 490 OHM 1% 1/2W	28480	0727-0075	2
0727-0100	R:FXD DEPC 1000 OHM 1% 1/2W	28480	0727-0100	2
0727-0106	R:FXD DEPC 1.23K OHM 1/2% 1/2W	28480	0727-0106	1
0727-0109	R:FXD DEPC 1470 OHM 1% 1/2W	28480	0727-0109	3
0727-0122	R:FXD DEPC 2.51K OHM 1% 1/2W	28480	0727-0122	2
0727-0142	R:FXD DEPC 6.2K OHM 1% 1/2W	28480	0727-0142	2
0727-0148	R:FXD DEPC 7.842K OHM 1% 1/2W	28480	0727-0148	2
0727-0149	R:FXD DEPC 7.96K OHM 1% 1/2W	28480	0727-0149	2
0727-0158	R:FXD DEPC 10.1K OHM 1% 1/2W	28480	0727-0158	2
0727-0171	R:FXD DEPC 18.37K OHM 1% 1/2W	28480	0727-0171	1
0727-0173	R:FXD DEPC 20K OHM 1% 1/2W	28480	0727-0173	2
0727-0178	R:FXD DEPC 24.7K OHM 1% 1/2W	28480	0727-0178	2
0727-0187	R:FXD DEPC 37.4K OHM 1% 1/2W	28480	0727-0187	1
0727-0195	R:FXD DEPC FLM 50K OHM 1% 1W	28480	0727-0195	1
0727-0196	R:FXD DEPC 52.6K OHM 1% 1/2W	28480	0727-0196	1
0727-0202	R:FXD DEPC FLM 83K OHM 1% 1/2W	28480	0727-0202	1
0727-0218	R:FXD DEPC 180K OHM 1% 1/2W	28480	0727-0218	1
0727-0221	R:FXD DEPC 200K OHM 1% 1/2W	28480	0727-0221	1
0727-0232	R:FXD DEPC 312K OHM 1% 1/2W	28480	0727-0232	1
0727-0233	R:FXD DEPC 333K OHM 1% 1/2W	28480	0727-0233	1
0727-0244	R:FXD DEPC 500K OHM 1% 1/2W	28480	0727-0244	1
0727-0254	R:FXD DEPC 750K OHM 1% 1/2W	28480	0727-0254	1
0727-0255	R:FXD DEPC 800K OHM 1% 1/2W	28480	0727-0255	2
0727-0292	R:FXD DEPC 3 MEGOHM 1% 1/2W	28480	0727-0292	1
0727-0332	R:FXD DEPC 150K OHM 1% 1/2W	28480	0727-0332	1
0727-0348	R:FXD DEPC 80.84K OHM 1/2% 1/2W	28480	0727-0348	2
0727-0352	R:FXD DEPC 1200 OHM 1/2% 1/2W	28480	0727-0352	1
0727-0361	R:FXD DEPC 2802 OHM 1/2% 1/2W	28480	0727-0361	1
0727-0362	R:FXD DEPC 3673 OHM 1/2% 1/2W	28480	0727-0362	1
0727-0363	R:FXD DEPC 5171 OHM 1/2% 1/2W	28480	0727-0363	3
0727-0364	R:FXD DEPC 5200 OHM 1/2% 1/2W	28480	0727-0364	2
0727-0371	R:FXD DEPC 9760 OHM 1/2% 1/2W	28480	0727-0371	2
0727-0398	R:FXD DEPC 3.79K OHM 1/2% 1/2W	28480	0727-0398	1
0727-0402	R:FXD DEPC 46.67K OHM 1/2% 1/2W	28480	0727-0402	1
0727-0407	R:FXD DEPC 82.09K OHM 1/2% 1/2W	28480	0727-0407	2
0727-0410	R:FXD DEPC 256.8K OHM 1/2% 1/2W	28480	0727-0410	1
0727-0412	R:FXD DEPC 21.5K OHM 1% 1/2W	28480	0727-0412	1
0727-0954	R:FXD DEPC FLM 5.5K OHM 1% 1/2W	28480	0727-0954	2
0730-0065	R:FXD DEPC 90.5K OHM 1% 1W	28480	0730-0065	3
0757-0044	R:FXD MET FLM 33.2K OHM 1% 1/2W	19701	MF 1/2 T-0	2
0757-0059	R:FXD MET FLM 1 MEGOHM 1% 1/2W	28480	0757-0059	1
0757-0089	R:FXD MET FLM 1K OHM 2% 1/2W	28480	0757-0089	9
0757-0135	R:FXD MET FLM 511K OHM 1% 1/2W	28480	0757-0135	3
0757-0137	R:FXD MET FLM 750K OHM 1% 1/2W	28480	0757-0137	1
0757-0159	R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159	1
0757-0199	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199	1
0757-0280	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280	1

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0757-0310	R:FXD MET FLM 133K OHM 1% 1/2W	28480	0757-0310	1
0757-0312	R:FXD MET FLM 309K OHM 1% 1/2W	28480	0757-0312	5
0757-0464	R:FXD MET FLM 90.9K OHM 1% 1/8W	28480	0757-0464	1
0757-0465	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465	3
0757-0833	R:FXD MET FLM 5.11K OHM 1% 1/2W	28480	0757-0833	1
0757-0836	R:FXD MET FLM 7.5K OHM 1% 1/2W	28480	0757-0836	1
0757-0839	R:FXD MET FLM 10.0K OHM 1% 1/2W	28480	0757-0839	1
0757-0855	R:FXD MET FLM 68.1K OHM 1% 1/2W	28480	0757-0855	2
0757-1060	R:FXD MET FLM 196 OHM 1% 1/2W	28480	0757-1060	3
0757-1077	R:FXD MET FLM 15.5K OHM 1%1/2W	28480	0757-1077	2
0757-1078	R:FXD MET FLM 1.47K OHM 1% 1/2W	28480	0757-1078	1
0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	28480	0758-0005	1
0758-0010	R:FXD MET OX FLM 3300 OHM 5% 1/2W	28480	0758-0010	3
0758-0015	R:FXD MET FLM 220 OHM 5% 1/2W	28480	0758-0015	1
0758-0018	R:FXD MET OX 15K OHM 5% 1/2W	28480	0758-0018	1
0758-0019	R:FXD MET FLM 18K OHM 5% 1/2W	28480	0758-0019	1
0758-0021	R:FXD MET OX 51K OHM 5% 1/2W	28480	0758-0021	4
0758-0024	R:FXD MET FLM 100 OHM 5% 1/2W	28480	0758-0024	1
0758-0035	R:FXD MET FLM 3000 OHM 5% 1/2W	28480	0758-0035	1
0758-0037	R:FXD MET FLM 5100 OHM 5% 1/2W	28480	0758-0037	1
0758-0039	R:FXD MET FLM 20K OHM 5% 1/2W	28480	0758-0039	1
0758-0057	R:FXD MET FLM 5600 OHM 5% 1/2W	28480	0758-0057	1
0758-0064	R:FXD MET FLM 36K OHM 5% 1/2W	28480	0758-0064	1
0758-0066	R:FXD MET FLM 620 OHM 5% 1/2W	28480	0758-0066	1
0758-0073	R:FXD MET FLM 24K OHM 5% 1/2W	28480	0758-0073	2
0758-0074	R:FXD MET OX 27K OHM 5% 1/2W	28480	0758-0074	1
0760-0033	R:FXD MET FLM 249K OHM 1% 2W	65092	854-B	4
0764-0007	R:FXD MET FLM 27K OHM 5% 2W	28480	0764-0007	2
0764-0031	R:FXD MET OX FLM 47K OHM 2W	28480	0764-0031	3
0764-0040	R:FXD MET OX FLM 39K OHM 5%	28480	0764-0040	2
0764-0046	R:FXD MET OX FLM 33K OHM 5% 2W	28480	0764-0046	2
0765-0007	R:FXD MET FLM 15K OHM 10% 2W	28480	0765-0007	2
0773-0004	R:FXD MET FLM 10K OHM 5% 5W	28480	0773-0004	1
0773-0005	R:FXD MET FLM 12K OHM 5% 5W	28480	0773-0005	1
0773-0006	R:FXD MET FLM 15K OHM 5% 5W	28480	0773-0006	1
0811-0266	R:FXD WW 55K OHM 1% 3/4W	28480	0811-0266	3
0811-0267	R:FXD WW 55K OHM 1% 1W	28480	0811-0267	1
0811-0268	R:FXD WW 74K OHM 1% 3/4W	28480	0811-0268	1
0811-0269	R:FXD WW 1600 OHM 1% 1/4W	28480	0811-0269	1
0812-0017	R:FXD WW 0.25 OHM 5% 3W	28480	0812-0017	3
0812-0018	R:FXD WW 100 OHM 5% 5W	94310	5W57G101(COMM EQUIV)	1
0816-0015	R:FXD WW 50 OHM 10% 10W	28480	0816-0015	1
0839-0006	THERMISTOR:10 OHM 10%	24446	2D-754	1
0960-0008	CIRCULATOR:3-PORT	11870	OBD	1
1010-0005	INDICATOR:ELAPSED TIME	28480	1010-0005	1
1120-0156	MICROAMMETER:25UA-0-25UA ZERO CENTER	28480	1120-0156	1
1200-0002	SOCKET:VACUUM TUBE OCTAL CERAMIC	71785	101-29-22-033	2
1200-0009	SOCKET:TUBE 7-PIN MINAT	91662	04-703-05	3
1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	76530	294457	9
1200-0053	SOCKET:TUBE 7 PIN MINAT	71785	11151-11	2

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
1200-0058	SOCKET-TUBE	91662	3901PHSPTD	4
1200-0059	SOCKET-TUBE	28480	1200-0059	2
1200-0062	SOCKET:TUBE 9 PIN	71785	121-51-11-060	6
1200-0076	INSULATOR:TRANSISTOR	02735	DF 14A	1
1200-0086	SOCKET:NUVISTOR 5-PIN	71785	1336510009	5
1200-0087	CLAMP:TRANSISTOR	02735	DF-13-A	1
1200-0092	BUSHING:TRANSISTOR	02735	495334-1	1
1200-0114	SOCKET:ELECTRON TUBE NUVISTOR MICA	71785	133-65-10-003	1
1200-0147	SLEEVE:INSULATOR NYLON NO.4	26365	974-302	16
1205-0025	HEAT SINK:NUT	13103	1101A-1	2
1205-0026	HEAT SINK:BODY	13103	1101A-2(SPL)	2
1210-0004	CLAMP:CAPACITOR	24446	C103-22F14	1
1220-0009	SHIELD-TUBE	71785	12627	1
1250-0045	CONNECTOR:ELECTRICAL RF BNC (PLUG) RECPT	91737	5942	1
1250-0083	CONNECTOR:BNC PART OF A5	28480	1250-0083	1
1250-0102	CONNECTOR:BNC FEMALE	91737	1250-0102	7
1250-0149	CONNECTOR:RF BNC RIGHT-ANGLE	91737	UG-1174/U	2
1250-0207	R:FXD COAX TERM 50 OHM EXT MIXER INPUT	95712	30450-1	1
1250-0212	CONNECTOR:JACK CHASSIS BNC	95712	30409-1	6
1250-0238	CONNECTOR:RF CABLE JACK BNC PART OF W16	91737	6003	1
1250-0720	CONNECTOR:INPUT TO MIXER/COUPLER	28480	1250-0720	1
1250-0731	CONNECTOR:RF BNC BULKHEAD MOUNT	95712	12828-1	1
1250-0792	CONNECTOR:RF BNC BULKHEAD MOUNT	91637	30739-1	1
1250-0793	CONNECTOR:RF BNC RT-ANGLE BULKHEAD	95712	8306-1	3
1250-0815	INSULATOR:RF CONNECTOR	02660	131-1053	2
1250-0916	BODY:RF CONNECTOR	02660	131-148	1
1250-0917	CONTACT:RF CONNECTOR	02660	131-147	4
1251-0095	RECEPTACLE:SWITCHED LINE OUTPUT	75382	221	1
1251-0143	CONNECTOR:FEMALE 14 CONTACT	28480	1251-0143	1
1251-0156	SPRING:GROUND PIN	28480	1251-0156	1
1251-0158	CONNECTOR:6 CONTACTS	95354	CD 606S	1
1251-0172	CONNECTOR:22 CONTACTS	28480	1251-0172	1
1251-0194	CONNECTOR:15 CONTACTS PC	95354	SD 615TS	4
1251-1556	CLIP:RESISTOR LEAD	28480	1251-1556	1
1400-0084	POST:FUSEHOLDER	75915	342014	1
1401-0006	CAP, PLATE, CERAMIC	76487	36002	2
1401-0007	CAP, PLATE, CERAMIC	76487	36004	2
1410-0110	BUSHING:PANEL	28480	1410-0110	1
1450-0110	LAMPHOLDER ASSEMBLY:5-SOCKETS	28480	1450-0110	1
1460-0091	SPRING:COMPRESSION 0.09-0.11D X 1-3/8	28480	1460-0091	1
1460-0113	SPRING:JUMPER(C2 TO C3)	28480	1460-0113	1
1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	94154	2N383	3
1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	28480	1850-0062	5
1850-0064	TRANSISTOR:GERMANIUM 2N1183 PNP	02735	2N1183	1
1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	28480	1850-0098	9
1853-0001	TRANSISTOR:PNP SILICON 30V 900MW	28480	1853-0001	1
1853-0020	TRANSISTOR:SILICON PNP	28480	1853-0020	1
1854-0003	TRANSISTOR:NPN SILICON	28480	1854-0003	4
1854-0005	TRANSISTOR:SILICON NPN 2N708	07263	2N708	3
1854-0071	TRANSISTOR:SILICON NPN 2N3391	28480	1854-0071	2
1854-0073	TRANSISTOR:SILICON NPN 2N3478	28480	1854-0073	1
1854-0251	TRANSISTOR:SILICON NPN	28480	1854-0251	5
1855-0001	TRANSISTOR:SIL UNIJUNCTION 2N1671A	03508	2N1671A	1

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

℗ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
1900-0016	DIODE:SILICON POINT CONTACT	93332	1N4603	1
1901-0025	SEMICON DEVICE:DIODE JUNCTION	28480	1901-0025	19
1901-0029	DIODE:SILICON 600PIV	28480	1901-0029	4
1901-0030	DIODE:SILICON 800PIV	28480	1901-0030	4
1901-0032	DIODE:SILICON 100PIV 15A	04713	1N3209	2
1901-0033	DIODE:SILICON 100MA AT +1V 180PIV	28480	1901-0033	10
1901-0036	DIODE:SILICON 1000PIV	28480	1901-0036	2
1901-0040	SEMICON DEVICE:DIODE SILICON	28480	1901-0040	1
1901-0084	RECTIFIER:SILICON 50MA 4000PIV	12060	DI-1163	1
1901-0166	SEMICON DEVICE:DIODE	28480	1901-0166	1
1901-0169	DIODE:SILICON	28480	1901-0169	1
1901-0196	DIODE:SILICON	28480	1901-0196	2
1902-0009	DIODE:BREAKDOWN 7.50 V 10%	28480	1902-0009	1
1902-0017	DIODE:BREAKDOWN:6.81V 10% 400 MW	28480	1902-0017	5
1902-0031	DIODE BREAKDOWN:12.7V 5%	28480	1902-0031	1
1902-0057	DIODE:BREAKDOWN 6.49 5% 400MW	28480	1902-0057	1
1902-0070	DIODE:SILICON BREAKDOWN 6.6V 5%	28480	1902-0070	1
1902-0214	DIODE:BREAKDOWN SILICON 56.2V 10%	28480	1902-0214	1
1902-0215	DIODE BREAKDOWN:SILICON 6.49V 5%	28480	1902-0215	1
1902-0223	DIODE BREAKDOWN:SILICON 15.4V 5%	28480	1902-0223	1
1902-0314	DIODE:SILICON BREAKDOWN 7.50V 5%	28480	1902-0314	1
1921-0005	ELECTRON TUBE: 6C4 TRIODE	33173	6C4	1
1921-0013	ELECTRON TUBE:6CW4	86684	6CW4	3
1921-0015	ELECTRON TUBE: 8056 NUVISTOR TRIODE	86684	8056	1
1921-0026	ELECTRON TUBE:8058 NUVISTOR TRIODE	86684	8058	1
1921-0041	ELECTRON TUBE:NUVISTOR TRIODE 7895	86684	7895	1
1923-0045	ELECTRON TUBE: 7239 PENTODE	33173	7239	2
1923-0046	ELECTRON TUBE: 6EJ7 PENTODE	73445	6EJ7(EF184)	1
1923-0048	ELECTRON TUBE: 8068 BEAM PENTODE	33173	8068	2
1932-0022	ELECTRON TUBE:6DJ8/ECC 88 DUAL TRIODE	73445	6DJ8/ECC 88	1
1932-0027	ELECTRON TUBE: 12AT7 DUAL TRIODE	00011	2AT7	1
1932-0030	ELECTRON TUBE: 12AX7 TWIN TRIODE 9 PIN MIN	00001	12AX7	1
1932-0064	ELECTRON TUBE: 6201	73445	6201	1
1932-0049	TUBE:ELECTRON TWIN TRIODE CK 647	81453	CK 647	1
1940-0010	ELECTRON TUBE:0G3	73445	0G3	3
1951-0030	ELECTRON TUBE:BWO 2-4GC STEWART	28480	1951-0030	1
1960-0002	TUBE-ELECTRON EIA 6299	33173	GL6299	1
2100-0011	R:VAR COMP 5000 OHM LIN 1/2W	28480	2100-0011	1
2100-0044	R:VAR COMP 50K OHM 10% 2W	28480	2100-0044	1
2100-0053	R:VAR COMP 10K OHM 10% LIN 2W	28480	2100-0053	1
2100-0090	R:VAR COMP 2000 OHM 30% LIN 1/3W	28480	2100-0090	1
2100-0091	R:VAR COMP 5000 OHM 30% LIN 1/3W	28480	2100-0091	1
2100-0141	R:VAR COMP 50K OHM 20% LIN 1/4W	28480	2100-0141	2
2100-0153	R:VAR 2000 OHM 20% LIN 1/2W	28480	2100-0153	1
2100-0730	R:VAR COMP 100 OHM 10% LIN 2.2W	28480	2100-0730	1
2100-0741	R:VAR WW 5K OHM 5%	28480	2100-0741	2
2100-0758	R:VAR WW 200K OHM 3% LIN 10-TURN	28480	2100-0758	1
2100-0803	R:VAR WW 20K OHM 5% LINEAR 360 DEGREE ROT	28480	2100-0803	1
2100-0806	R:VAR WW 5K OHM 5%	28480	2100-0806	3
2100-0901	R:VAR COMP 7.5K 20% 1/2W W/SPDT SWITCH	28480	2100-0901	1
2100-0941	R:VAR WW 1000 OHM 5%	28480	2100-0941	2

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	
2100-0942	R:VAR MET FLM 50K OHM 20%	28480	2100-0942	3	
2100-0944	R:VAR MET FLM 200K OHM 5%	28480	2100-0944	2	
2100-0945	R:VAR MET FLM 500K OHM 5%	28480	2100-0945	7	
2100-0969	R:VAR MET FLM 50K OHM 20%	28480	2100-0969	1	
2100-1437	R:VAR WW 20K OHM 5% 1W	28480	2100-1437	2	
2100-1569	R:VAR COMP 5K OHM 20% LIN 1/2W	28480	2100-1569	1	
2100-1762	R:VAR WW 20K OHM 10% LIN 1/2W	28480	2100-1762	1	
2110-0029	FUSE:CARTRIDGE 3 AMP 125V SLOW BLOW	75915	313003	1	
2110-0059	FUSE:CARTRIDGE 1-1/2A SLO-BLO	71400	MDL 1.5	1	
2140-0008	LAMP:NEON NE2	24455	NE2	2	
2140-0010	LAMP:INCANDESCENT 6 VOLT	24455	TYPE 51	5	
2140-0015	LAMP:GLOW NEON NE-2H	24455	NE 2H	4	
2190-0004	WASHER:LOCK INT TOOTH 4-40	78452	OBD	3	
2190-0007	WASHER:NO.6 W/INTERNAL LOCK	00000		1	
2190-0017	WASHER:LOCK SPLIT-RING PH BRZ NP 5/64 NO 8	73734	OBD#	4	
2200-0003	SCREW:MACHINE RH SST 4-40 X 1/4	73076	OBD#	2	
2200-0005	SCREW:MACHINE 4-40 X 5/16	80120	OBD	1	
2200-0010	SCREW:MACHINE RH SST 4-40 X 7/8	00000	OBD	7	
2360-0016	SCREW:MACHINE RH SST 6-32 X 1-1/4	80120	OBD#	1	
2370-0020	SCREW:FH PHIL DR 6-32 X 5/16	00000	OBD	8	
2370-0021	SCREW:PHIL DR 6-32 X 7/16	00000	OBD	8	
2410-0001	SCREW:MACHINE OV SST PHILLIPS DR 6-32X5/8	73734	OBD#	1	
2420-0001	NUT:HEX ST NP 6-32 X 5/16 W/LOCKWASHER	78189	OBD#	1	
2515-0017	SCREW:PAN HD W/LOCK 8-32 X 1/4	80120	OBD	4	
2530-0011	SCREW:FH SLOT DR W/LOCK 8-32	78189	OBD#	10	
2550-0013	SCREW:BH PHIL DR 8-32 X 5/16	28480	2550-0013	4	
2950-0004	NUT:HEX 1/4-20	80120	OBD	2	
3030-0007	SCREW:HEX SOCKET DR CP STL 4-40 X 0.125	00000	OBD	1	
3030-0017	SCREW:MACHINE CAP 8-32 X 1/2 INCH	284803	030-0017	3	
3030-0065	SCREW:CAP 6-32X7/16	70276	OBD	2	
3030-0147	SCREW:SET 6-32 X 3/8 W/LOCK STRIP	28480	3030-0147	2	
3050-0066	WASHER:FLAT BRS NP 0.147 ID X 3/8	73734	OBD#	2	
3050-0116	WASHER:FLAT NO 5	00000		1	
3100-0833	ROTARY SWITCH	28480	3100-0833	1	
3100-0835	SWITCH:ROTARY PART OF S4	28480	3100-0835	1	
3100-1593	SWITCH:ROTARY 4-SECT 8-POS	28480	3100-1593	1	
3100-1594	SWITCH:ROTARY 4-SECT-18-POS	28480	3100-1594	1	
3100-1595	SWITCH:ROTARY 2-SECT 8 POSITION	28480	3100-1595	1	
3101-0004	SWITCH:PUSH SPDT NC MOMENTARY ACT REF CHK	82389	3S-1406	1	
3101-0034	SWITCH:SLIDE 4 PDT 0.5 AMP 125 VDC	42190	6633	1	
3101-0041	SWITCH:TOG DPDT 3 POS 15 AMP 125VAC	88140	8906K370	1	
3106-0002	SWITCH:COAXIAL 24V SPDT	02660	318-10382-3	2	
3106-0005	SWITCH:COAXIAL 24V SPDT	96341	MA-7524-PND	1	
3140-0010	MOTOR:AC 1/175 HP 2800 RPM FIG 6-5	73793	ER 6667	1	
3160-0013	BLADE FAN 4 BLADES 4-1/2	06812	0 4527 4	1	
5000-0055	TRIM:ALUMINUM STRIP	28480	5000-0055	2	
5000-0234	CONTACT:SPRING	28480	5000-0234	4	
5000-0750	COVER:SIDE UNPERFORATED	28480	5000-0750	2	
5020-0366	RING:CONTACT	28480	5020-0366	1	
5020-3334	CONNECTOR SHELL:BULKHEAD TYPE N	28480	5020-3334	2	
5020-3249	PIN:FEMALE	28480	5020-3249	2	
5040-0234	LAMPHOLDER	28480	5040-0234	4	
5040-0235	LAMP:BASE	28480	5040-0235	4	

See list of abbreviations in introduction to this section

Table 6-4. **Replaceable Parts** (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	
5040-0601	SUPPORT:PLASTIC	28480	5040-0601	1	
5060-0740	COVER ASSY:TOP, UNPERFORATED	28480	5060-0740	1	
5060-0752	COVER ASSY:BOTTOM UNPERFORATED	28480	5060-0752	1	
5060-0763	HANDLE ASSY	28480	5060-0763	2	
5060-0765	RETAINER:HANDLE	28480	5060-0765	2	
5060-0767	FOOT ASSY	28480	5060-0767	5	
5060-0807	FRAME ASSY:LEFT SIDE	28480	5060-0807	1	
5060-0878	FILTER ASSY:AIR FAN	28480	5060-0878	2	
5080-0221	DIODE ASSY	28480	5080-0221	1	
6960-0006	PLUG BUTTON:FOR 1/4" HOLE	83058	SS-48151	1	
8120-0078	CABLE:POWER 7.5 FT.	28480	8120-0078	1	
9100-0268	TRANSFORMER:POWER 1000-150 VOLTS	28480	9100-0268	1	
9100-0269	TRANSFORMER:POWER	28480	9100-0269	1	
9100-0270	TRANSFORMER:POWER	28480	9100-0270	1	
9100-0319	COIL:VAR 0.08-0.01 UH	28480	9100-0319	1	
9100-0321	COIL:VAR 3-6 UH	28480	9100-0321	1	
9100-0324	TRANSFORMER:VAR OUTPUT	28480	9100-0324	1	
9110-0104	LINE FILTER:LOW-PASS	28480	9110-0104	1	
9140-0095	COIL:RF FXD 0.27UH 10%	99800	1537 SERIES	1	
9140-0098	COIL:FXD RF 2.2 UH	28480	9140-0098	1	
9140-0100	COIL:FXD RF 4.7 UH	28480	9140-0100	8	
9140-0111	COIL:FXD RF 3.3UH	28480	9140-0111	7	
9140-0114	COIL:FXD RF 10 UH	28480	9140-0114	1	
9140-0115	COIL:RF FXD 22UH 10%	99800	2150-32	4	
9140-0121	COIL:FXD 1.8 UH	28480	9140-0121	1	
9140-0136	COIL:FXD RF 22 UH	28480	9140-0136	1	
9140-0143	COIL:FXD RF 3.3 UH	28480	9140-0143	2	
9140-0146	COIL:RF FIXED 100H 10%	99800	1025-44	2	
9140-0155	COIL:FXD RF 28 UH	28480	9140-0155	1	
9140-0159	COIL:FXD 0.47UH 20%	99800	1025-SERIES	2	
9140-0179	COIL-FXD R.F. 22 UH 10% 275 MA	99800	1537-44	1	
00354-229	CONDUCTOR:CENTER	28480	00354-229	2	
00774-209	RESISTOR CONE	28480	00774-209	1	
08551-0009	HOLDER:AIR FILTER	28480	08551-0009	1	
08551-0020	BOTTOM:CONVERTER	28480	08551-0020	1	
08551-0021	WASHER: TUBE	28480	08551-0021	3	
08551-0022	COVER CAN:A19CR16,A19CR17,A19Q9	28480	08551-0022	1	
08551-0023	SCREEN:FILTER	28480	08551-0023	1	
08551-0026	SHIELD:DISCRIMINATOR	28480	08551-0026	1	
08551-0027	BRACKET, TUBE MTG.	28480	08551-0027	1	
08551-0028	RETAINER:SCREEN	28480	08551-0028	1	
08551-0032	PLATE:SHOCK MOUNT	28480	08551-0032	1	
08551-0049	CLAMP:SAMPLER/SEARCH DRIVE BU	28480	08551-0049	1	
08551-0050	STIFFENER:PC BOARD	28480	08551-0050	1	
08551-0067	GASKET-RFI	28480	08551-0067	1	
08551-0073	GASKET:RFI LOCK ASSY CASTING TOP COVER	28480	08551-0073	1	
08551-0074	BRACKET:CONVERTER	28480	08551-0074	1	
08551-0103	REAR PANEL	28480	08551-0103	1	
08551-0114	BRACKET:CIRCULATOR SUPPORT	28480	08551-0114	1	
08551-0115	FRONT PANEL	28480	08551-0115	1	
08551-0119	COVER:FILTER BLOCK	28480	08551-0119	1	
08551-0121	GASKET:FILTER BLOCK	28480	08551-0121	1	

See list of abbreviations in introduction to this section

Table 6-4. Replaceable Parts (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
08551-0123	GASKET:COUPLER BLOCK	28480	08551-0123	3
08551-0124	TOP:CONVERTER	28480	08551-0124	1
08551-0125	GASKET:RFI	28480	08551-0125	1
08551-0126	BRACKET, CLAMPING	28480	08551-0126	1
08551-0128	BRACKET, CLAMPING	28480	08551-0128	1
08551-2037	SLUG:TUNING	28480	08551-2037	1
08551-2041	POST:DIODE	28480	08551-2041	1
08551-2052	WINDOW	28480	08551-2052	1
08551-2072	STRIP:MIXER/COUPLER	28480	08551-2072	1
08551-2073	BOARD:MIXER/COUPLER	28480	08551-2073	1
08551-2140	LOCK:SLUG P/O TUNING SLUG	28480	08551-2140	1
08551-2155	SPACER	28480	08551-2155	1
08551-2171	BOARD:SEARCH DRIVE BARE PC BD	28480	08551-2171	1
08551-2172	BOARD, PULSE AMPL	28480	08551-2172	1
08551-2175	BLANK BOARD:HELIX CONTROL	28480	08551-2175	1
08551-2176	BOARD:HELIX VOLT-SHAPER (BARE PC BD)	28480	08551-2176	1
08551-2177	BOARD:LOW-VOLTAGE RECT.(BARE PC BD)	28480	08551-2177	1
08551-2179	BOARD,HV TIME DELAY:BARE PC BD	28480	08551-2179	1
08551-2180	BARE BOARD:LOW VOLTAGE POWER SUPPLY	28480	08551-2180	1
08551-2181	BOARD, METER:BARE PC BD	28480	08551-2181	1
08551-2185	BOARD:180MC OSCILLATOR BARE PC BD	28480	08551-2185	1
08551-2210	BOARD:200 MC MIXER PC	28480	08551-2210	1
08551-2211	BOARD:200 MC AMPLIFIER PC	28480	08551-2211	1
08551-2212	BARE PRINTED CIRCUIT BOARD	28480	08551-2212	1
08551-2306	BOARD:MIXER BARE PC BD	28480	08551-2306	1
08551-2308	BODY:MIXER	28480	08551-2308	1
08551-2309	COVER:CHOKE CAVITY	28480	08551-2309	1
08551-2310	COVER:IF CAVITY	28480	08551-2310	1
08551-2311	BLOCK:FILTER	28480	08551-2311	1
08551-2313	CONNECTOR:INPUT TO COAXIAL MIXER	28480	08551-2313	1
08551-2314	BEAD:CONDUCTOR SUPPORT	28480	08551-2314	1
08551-2315	BEAD:CAVITY	28480	08551-2315	2
08551-2316	CAP:DIODE HOLDER	28480	08551-2316	1
08551-2317	CENTER CONDUCTOR	28480	08551-2317	1
08551-2318	C:FXD CER 1000 PF +80-20% 500VDW	28480	08551-2318	1
08551-2319	HOLDER:DIODE	28480	08551-2319	1
08551-2322	SPACER:CONNECTOR	28480	08551-2322	1
08551-2331	BEAD:POLYIRON	28480	08551-2331	1
08551-2358	ROD:ADAPTER	28480	08551-2358	1
08551-2363	SLUG:TUNING(ALTERNATE FOR 08551-2037)	28480	08551-2363	1
08551-2364	CASTING:CONVERTER	28480	08551-2364	1
08551-2366	BOARD:BLANK BUFFER AMPLIFIER	28480	08551-2366	1
08551-4002	DIAL DRUM ASSY FIG 6-8	28480	08551-4002	1
08551-4003	FILTER:RF	28480	08551-4003	1
08551-4004	FILTER ASSY:2 GC	28480	08551-4004	1
08551-4005	TURRET:MAIN	28480	08551-4005	1
08551-6000	LOW PASS FILTER ASSY	28480	08551-6000	1
08551-6007	BOARD ASSY:METER	28480	08551-6007	1
08551-6012	CABLE ASSY:LP FLT OUTPUT	28480	08551-6012	3
08551-6013	CABLE ASSY:EXT JUMPER 2GC IF AMPL	28480	08551-6013	2

See list of abbreviations in introduction to this section

Table 6-4. **Replaceable Parts** (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
08551-6014	CABLE ASSY:2GC MIXER OUTPUT(A7)	28480	08551-6014	3
08551-6020	CABLE ASSY:EXTERNAL MIXER INPUT	28480	08551-6020	1
08551-6021	CABLE ASSY:LO OUTPUT PART OF A2	28480	08551-6021	1
08551-6022	CABLE ASSY:A2 MIXER/COUPLER FLT OUTPT	28480	08551-6022	1
08551-6023	CABLE ASSY:180 MC FROM A6 HARM. GEN	28480	08551-6023	1
08551-6024	TUNED CABLE ASSY: FROM A6 HARM.GEN	28480	08551-6024	1
08551-6027	CABLE ASSY:A2 MIXER/COUPLER INPUT	28480	08551-6027	1
08551-6031	CONVERTER ASSY(SEE TABLE 6-2)	28480	08551-6031	2
08551-6037	CABLE ASSY:A7 2GC MIXER IN 10-IN COAX	28800	8551-6037	4
08551-6038	CABLE ASSY:CONTROL-INTERCONNECTING	28480	08551-6038	1
08551-6040	HELIX CONTROL ASSY	28480	08551-6040	1
08551-6043	FAN MOTOR ASSY	28480	08551-6043	1
08551-6045	LV RECTIFIER ASSY:	28480	08551-6045	1
08551-6048	SWITCH ASSY:SPECTRUM WIDTH	28480	08551-6048	1
08551-6049	HELIX VOLTAGE SHAPER ASSY:(STEW. BWO)	28480	08551-6049	1
08551-6051	180MC OSCILLATOR BOARD ASSY.	28480	08551-6051	1
08551-6054	HV TIME DELAY ASSEMBLY	28480	08551-6054	1
08551-6057	LV SERIES REGULATOR ASSY	28480	08551-6057	1
08551-6058	LV POWER SUPPLY	28480	08551-6058	1
08551-6059	SWITCH ASSY:GAIN COMPENSATING	28480	08551-6059	1
08551-6063-9	CABLE ASSY:A15 DISC. OUTPUT TO A13	28480	08551-6063-9	1
08551-6063-8	CABLE ASSY:A14 SEARCH DRIVE TO A15	28480	08551-6063-8	1
08551-6065	CABLE HARNESS METER BOARD	28480	08551-6065	1
08551-6069	CONNECTOR LOAD ASSY	28480	08551-6069	1
08551-6100	LOCK ASSEMBLY(SEE TABLE 6-3)	28480	08551-6100	2
08551-6102	SAMPLER ASSEMBLY	28480	08551-6102	1
08551-6103	SAMPLER:DIRECTIONAL COUPLER ASSY	28480	08551-6103	1
08551-6104	BOARD ASSY.:PULSE AMPL	28480	08551-6104	1
08551-6105	SEARCH DRIVE ASSY	28480	08551-6105	1
08551-6111	TRANSFORMER:COUPLING	28480	08551-6111	1
08551-6112	TRANSFORMER:COUPLING	28480	08551-6112	1
08551-6116	HARMONIC GENERATOR ASSY FIG 6-6	28480	08551-6116	1
08551-6117	2GC MIXER ASSY FIG 6-8	28480	08551-6117	1
08551-6119	MIXER ASSY: 200-20 MC	28480	08551-6119	1
08551-6120	AMPLIFIER BOARD ASSY: 200 MC	28480	08551-6120	1
08551-6121	BOARD ASSY:10MC OSC/DISC	28480	08551-6121	1
08551-6122	EXTENDER:PC 22-PIN	28480	08551-6122	1
08551-6123	EXTENDER: PC 15-PIN	28480	08551-6123	1
08551-6124	FILTER ASSY:LOW-PASS	28480	08551-6124	1
08551-6127	CABLE ASSY: BWO V5 TO CIRCULATOR(AT1)	28480	08551-6127	1
08551-6132	STABILIZATION:SWITCH ASSY	28480	08551-6132	1
08551-6133	SWITCH ASSY.:SIGNAL IDENTIFIER	28480	08551-6133	1
08551-6135	KIT:RACK MOUNTING	28480	08551-6135	1
08551-6136	CABLE ASSY:FM A13 BD TO REAR PANEL J35	28480	08551-6136	1
08551-6148	INPUT ATTENUATOR ASSY FIG 6-1	28480	08551-6148	1
08551-6151	CARTRIDGE ASSY 0 DB	28480	08551-6151	1
08551-6153	CABLE ASSY:18 IN TRI-SHIELD COAX TERM	28480	08551-6153	1
08551-6154	CARTRIDGE RESISTOR CARD ASSY 10DB	28480	08551-6154	1
08551-6155	CARTRIDGE RESISTOR CARD ASSY 20DB	28480	08551-6155	1

See list of abbreviations in introduction to this section

Table 6-4. **Replaceable Parts** (Cont.)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
08551-6156	CARTRIDGE RESISTOR CARD ASSY 30DB	28480	08551-6156	1
08551-6157	CARTRIDGE RESISTOR CARD ASSY 40DB	28480	08551-6157	1
08551-6158	CARTRIDGE RESISTOR CARD ASSY 50DB	28480	08551-6158	1
08551-6159	CARTRIDGE RESISTOR CARD ASSY 60DB	28480	08551-6159	1
08551-6161	CABLE ASSY:16-IN TRI SHIELD COAX	28480	08551-6161	1
08551-6162	MIXER/COUPLER ASSY FIG 6-2	28480	08551-6162	1
08551-6164	BIAS GENERATOR ASSY	28480	08551-6164	1
08551-6165	CABLE ASSY:COAX MIXER OUTPUT(A3)	28480	08551-6165	1
08551-6166	FRONT PANEL ASSY	28480	08551-6166	1
08551-6167	COAX MIXER ASSY	28480	08551-6167	1
08551-6168	DIRECTIONAL COUPLER ASSY	28480	08551-6168	1
08551-6169	CAPACITOR ASSY:1150 PF	28480	08551-6169	1
08551-6170	SWITCH ASSY:FREQUENCY(GC)	28480	08551-6170	1
08551-6177	CABLE ASSY:15-IN TRI SHIELD COAX TERM	28480	08551-6177	1
08551-6178	CABLE ASSY:11-IN TRI SHIELD COAX TERM	28480	08551-6178	1
08551-6179	AMPLIFIER ASSY:2GC I.F. FIG 6-4	28480	08551-6179	1
08551-6180	CABLE ASSY:2GC I.F. AMPLIFIER INPUT	28480	08551-6180	1
08551-6181	CABLE ASSY:9-IN TRI SHIELD COAX TERM	28480	08551-6181	1
08551-6183	ASSY:180 MHZ BUFFER AMPLIFIER BOARD	28480	08551-6183	1
08551-6230	FRAME ASSY:RIGHT SIDE	28480	08551-6230	1
08551-8006	COIL:200 MC	28480	08551-8006	3
08551-8010	COIL:2.2UH	28480	08551-8010	1
08551-8011	COIL:DISC PRI	28480	08551-8011	1
08551-8012	COIL:DISC SEC	28480	08551-8012	1
08551-8013	R:CAP DISC:FXD 3 MEGOHM 10% 1/2W	28480	08551-8014	1
08551-8015	COIL	28480	08551-8015	1
08551-8016	COIL	28480	08551-8016	1
08551-8017	R:VAR WW 10K OHM	28480	08551-8017	1
08551-8025	DIODE:SILICON	28480	08551-8025	2

 # See list of abbreviations in introduction to this section

TABLE 6-5.
CODE LIST OF MANUFACTURERS

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address
00000	U. S. A. Common	Any supplier of U. S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N. Y.
00287	Cemco Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Microtron Co., Inc.	Valley Stream, N. Y.
00373	Garlock Inc.	Cherry Hill, N. J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp. Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N. J.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S. C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
00929	Microlab Inc.	Livingston, N. J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N. Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01930	Amerock Corp.	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N. Y.
02116	Wheelock Signals, Inc.	Long Branch, N. J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.
02660	Amphenol-Borg Electronics Corp.	Chicago, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N. J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
03508	G. E. Semiconductor Prod. Dept.	Syracuse, N. Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03877	Transitron Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N. J.
03954	Singer Co., Diehl Div. Finderne Plant	Sumerville, N. J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taurus Corp.	Lambertville, N. J.
04062	Arco Electronic Inc.	Great Neck, N. Y.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S. C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05277	Westinghouse Electric Corp. Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05397	Union Carbide Corp., Linde Div., Kemet Dept.	Cleveland, Ohio
05593	Illumitronic Engineering Co.	Sunnyvale, Calif.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N. Y.
05729	Metro-Tel Corp.	Westbury, N. Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Calif.
06175	Bausch and Lomb Optical Co.	Rochester, N. Y.
06402	E. T. A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N. Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N. H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Semcor Div. Components Inc.	Phoenix, Ariz.
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
06980	Varian Assoc. Eimac Div.	San Carlos, Calif.
07088	Kelvin Electric Co.	Van Nuys, Calif.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N. Y.
07149	Filmohm Corp.	New York, N. Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07261	Avnet Corp.	Culver City, Calif.
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Birtcher Corp., The	Monterey Park, Calif.
07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Calif.
07700	Technical Wire Products Inc.	Cranford, N. J.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Calif.
07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N. J.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08289	Blinn, Delbert Co.	Pomona, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Calif.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Calif.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08792	CBS Electronics Semiconductor Operations, Div of C. B. S. Inc.	Lowell, Mass.
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays Div.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N. Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11534	Duncan Electronics Inc.	Costa Mesa, Calif.
11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N. J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12136	Philadelphia Handle Co.	Camden, N. J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc. Data System Div.	Albuquerque, N. M.
12697	Clarostat Mfg. Co.	Dover, N. H.
12728	Elmar Filter Corp.	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Metex Electronics Corp.	Clark, N. J.
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13103	Thermolloy	Dallas, Texas
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell Dublier Electric Corp.	Newark, N. J.
14674	Corning Glass Works	Corning, N. Y.
14752	Electro Cube Inc.	San Gabriel, Calif.
14960	Williams Mfg. Co.	San Jose, Calif.
15203	Webster Electronics Co.	New York, N. Y.
15287	Scionics Corp.	Northridge, Calif.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15558	Micron Electronics	Garden City, Long Island, N. Y.
15566	Amprobe Inst. Corp.	Lynbrook, N. Y.
15631	Cabletronics	Costa Mesa, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Amelco Inc.	Mt. View, Calif.
16037	Spruce Pine Mica Co.	Spruce Pine, N. C.
16179	Omni-Spectra Inc.	Detroit, Ill.
16352	Computer Diode Corp.	Lodi, N. J.
16688	Ideal Prec. Meter Co., Inc. De Jur Meter Div.	Brooklyn, N. Y.
16758	Delco Radio Div. of G. M. Corp.	Kokoma, Ind.
17109	Thermonetics Inc.	Canoga Park, Calif.
17474	Tranex Company	Mountain View, Calif.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Calif.
17870	McGraw-Edison Co.	Manchester, N. H.
18042	Power Design Pacific Inc.	Palo Alto, Calif.
18083	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.
18324	Signetics Corp.	Sunnyvale, Calif.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18583	Curtis Instrument, Inc.	Mt. Kisco, N. Y.
18873	E. I. DuPont and Co., Inc.	Wilmington, Del.
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N. J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N. J.
19589	Concoa	Baldwin Park, Calif.
19644	LRC Electronics	Horseheads, N. Y.
19701	Electra Mfg. Co.	Independence, Kansas

From: FSC. Handbook Supplements
H4-1 Dated AUGUST 1966
H4-2 Dated NOV 1962

TABLE 6-5.
CODE LIST OF MANUFACTURERS (Cont)

Code No.	Manufacturer	Address
20183	General Atronics Corp.	Philadelphia, Pa.
21226	Executone, Inc.	Long Island City, N.Y.
21335	Fafnir Bearing Co., The	New Britain, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23783	British Radio Electronics Ltd.	Washington, D.C.
24455	G.E. Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobet File Co. of America, Inc.	Carlstadt, N.J.
26992	Hamilton Watch Co.	Lancaster, Pa.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products Ltd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W.H. & Hill, Ltd.	Toronto Ontario, Canada
37942	P.R. Mallory & Co. Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	Sanborn Company	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co.	Elizabeth, N.J.
60741	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Inc. Weston-Newark	Newark, N.J.
66295	Wittek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Cardwell Condenser Corp.	Lindenhurst L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Calif.
71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71700	Cornish Wire Co., The	New York, N.Y.
71707	Coto Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana General Corp., Electronics Div.	Keasby, N.J.
72699	General Instrument Corp., Cap. Div.	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Elect Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73586	Circle F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. MSL Industries Inc.	Philadelphia, Pa.
73734	Federal Screw Products Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Calif.
73957	Groov-Pin Corp.	Ridgefield, N.J.
74276	Signalite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75378	CTS Knights Inc.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Calif.
76433	General Instrument Corp., Micamold Division	Newark, N.J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N.J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phanostran Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77638	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Calif.
78947	Ucinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80120	Schnitzer Alloy Products Co.	Elizabeth, N.J.
80131	Electronic Industries Association. Any brand Tube meeting EIA Standards-Washington, DC.	
80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Inc.	Riverside, Calif.
80411	Acro Div. of Robertshaw Controls Co.	Columbus, Ohio
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Calif.
80583	Hammarlund Co., Inc.	New York, N.Y.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
81030	International Instruments Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	. . . . .
81483	International Rectifier Corp.	El Segundo, Calif.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Paramus, N.J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.

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TABLE 6-5.
CODE LIST OF MANUFACTURERS (Cont)

Code No.	Manufacturer	Address
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S.C.
83148	ITT Wire and Cable Div.	Los Angeles, Calif.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisade's Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A.J. Glesener Co., Inc.	San Francisco, Calif.
84411	TRW Capacitor Div.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Calif.
85474	R.M. Bracamonte & Co.	San Francisco, Calif.
85660	Koiled Kords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.
87034	Marco Industries	Anaheim, Calif.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87664	Van Waters & Rogers Inc.	San Francisco, Calif.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89473	G.E. Distributing Corp.	Schenectady, N.Y.
89665	United Transformer Co.	Chicago, Ill.
90179	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90970	Bearing Engineering Co.	San Francisco, Calif.
91146	ITT Cannon Elect, Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Calif.
91886	Malco Mfg. Co., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Calif.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co. Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Wesbury Long Island, N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Palisades Park, N.J.
93410	Stevens Mfg. Co., Inc.	Mansfield, Ohio
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp. Electronics Div.	East Paterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95236	Allies Products Corp.,	Dania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Siemon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Huggins Laboratories	Sunnyvale, Calif.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Troncis, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Calif.
98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98376	Zero Mfg. Co.	Burbank, Calif.
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99934	Renbrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
99957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

THE FOLLOWING HP VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N.J.
000AB	ETA	England
000BB	Precision Instrument Components Co.	Van Nuys, Calif.
000CS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
000MM	Rubber Eng. & Development	Hayward, Calif.
000NN	A "N" D Mfg. Co.	San Jose, Calif.
000QQ	Cooltron	Oakland, Calif.
000WW	California Eastern Lab.	Burlington, Calif.
000YY	S.K. Smith Co.	Los Angeles, Calif.

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SECTION VII
SCHEMATIC DIAGRAMS, WAVEFORM CHARTS, COMPONENT LOCATION INFORMATION

7-1. CONTENT.

7-2. This Section of the Manual includes:

a. Waveforms. Table 7-1.

b. Block Diagram. To relate 8551B and schematics: Figure 7-1.

c. Schematics.

Circuit	Figure No.
RF Input	7-15
Converter	7-18
Switching Logic	7-21
10MC Oscillator/Discriminator	7-26
Sampler/Search Drive	7-29
Helix Control Input	7-32
Helix Control	7-35
Primary Power	7-38
Low-Voltage Power Supply	7-41

d. Component Location Information.

Chassis Parts Locator: Table 7-2.

Assembly and component locator pictures.

To-and-from connections to assembly boards.

Table 7-1. Waveform Chart, Model 8551B RF Section

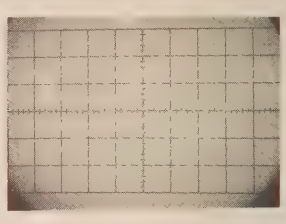
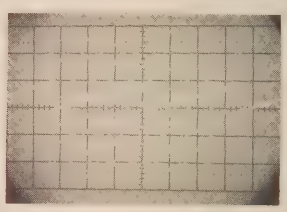
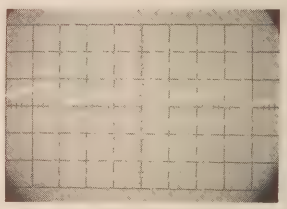
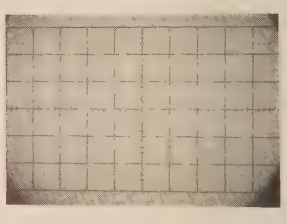
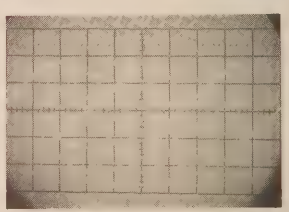
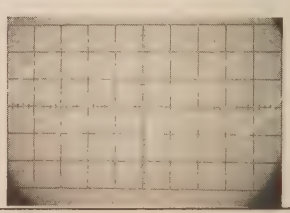
	Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
	PRIMARY POWER, SERIES REGULATOR Q1, Q2, Q3			
1		Collector, Q1 Collector, Q2 Collector, Q3	2 V/cm 2 ms/cm	
	HELIX CONTROL ASSEMBLY			
2	851/852 SWEEP TIME . . . . . 3 MILLISEC/CM SWEEP TIME VERNIER . . . . . CAL SYNC . . . . . INT 8551 SPECTRUM WIDTH . . . . . 3 MC/CM SPECTRUM WIDTH VERNIER CAL FREQUENCY(GC) . . . . . .01 - 2 TUNE . . . . . 2 Gc on LO Dial and set for FINE tuning STABILIZATION . . . . . STABILIZED	Grid, pin 2, A13V1	0.5 V/cm 10 ms/cm	
3		Grid, pin 7, A13V1	0.5 V/cm 10 ms/cm	
4		Plate, pin 6 A13V1	0.5 V/cm 10 ms/cm	
5		Cathode, pin 3, A13V2A	0.5 V/cm 10 ms/cm	
6		Grid, pin 2, A13V6	0.5 V/cm 10 ms/cm	

Table 7-1. Waveform Chart, Model 8551B RF Section (Cont.)

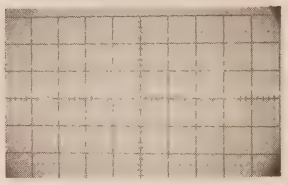
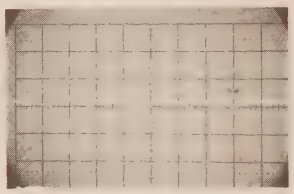
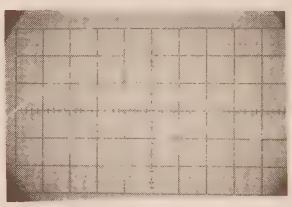
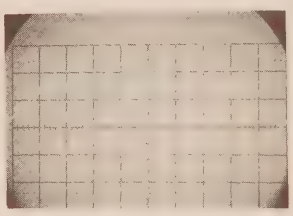
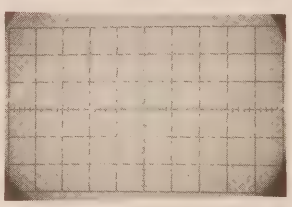
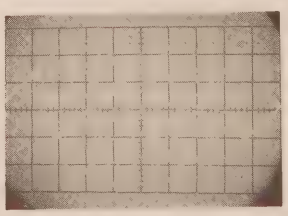
Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
HELIX CONTROL ASSEMBLY (cont.)			
7	Plate, pin 7, A13V6	0.05 V/cm 10 ms/cm	
8	Grid, pin 7, A13V7A Cathode, pin 8, A13V7A	0.05 V/cm 10 ms/cm	
9	Plate, A13V8 A13V9	5 V/cm 10 ms/cm	
10	Grid, pin 2, A13V7B	0.5 V/cm 10 ms/cm	
11	Cathode, pin 3, A13V6	0.5 V/cm 10 ms/cm	
SEARCH DRIVE ASSEMBLY			
12 851/852 SWEEP TIME . . . . . 3 MILLISEC/CM SWEEP TIME VERNIER . . . . . CAL SYNC . . . . . INT 8551 SPECTRUM WIDTH . . . . . 300 KC/CM SPECTRUM WIDTH VERNIER . . . CAL FREQUENCY(GC) . . . . . .01 - 2 TUNE . . . . . 2 Gc on LO Dial and set for FINE tuning STABILIZATION . . . . . STABILIZED	Grid, pin 7, A14V1A	1.0 V/cm 10 ms/cm	

Table 7-1. Waveform Chart, Model 8551B RF Section (cont.)

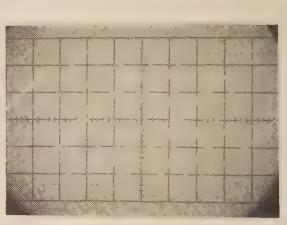
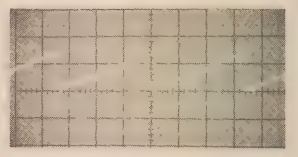
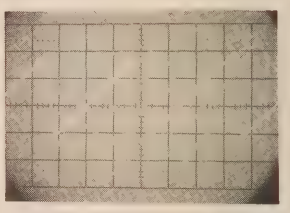
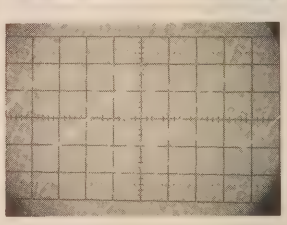
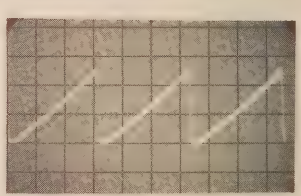
	Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
	SEARCH DRIVE ASSEMBLY (cont.)			
13		Grid, pin 2, A14V1B	0.5 V/cm 10 ms/cm	
	HELIX CONTROL ASSEMBLY			
14	851/852 SWEEP TIME . . . . . 3 MILLISEC/CM SWEEP TIME VERNIER . . . . . CAL SYNC . . . . . INT 8551 SPECTRUM WIDTH . . . . . 300 KC/CM SPECTRUM WIDTH VERNIER . . . CAL FREQUENCY(GC) . . . . . .01 - 2 TUNE . . . . . 2 Gc on LO Dial and set for FINE tuning STABILIZATION . . . . . STABILIZED	Grid, pin 2, A13V5A	1.0 V/cm 10 ms/cm	
15		Plate, pin 6, A13V5B	1.0 V/cm 10 ms/cm	
16		Cathode, pin 8, A13V2B	1.0 V/cm 10 ms/cm	
	10MC OSC/DISC. ASSEMBLY			
17	851/852 SWEEP TIME . . . . . 3 MILLISEC/CM SWEEP TIME VERNIER . . . . . CAL SYNC . . . . . INT 8551 SPECTRUM WIDTH . . . . . 1 MC/CM SPECTRUM WIDTH VERNIER . . . CAL FREQUENCY(GC) . . . . . .01 - 2 TUNE . . . . . 2 Gc on LO Dial and set for FINE tuning STABILIZATION . . . . . STABILIZED	Junction, A15C4 and A15A1R6	5 V/cm 10 ms/cm	

Table 7-1. Waveform Chart, Model 8551B RF Section (cont.)

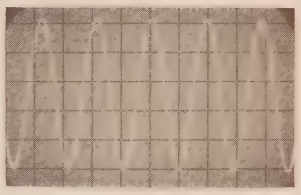
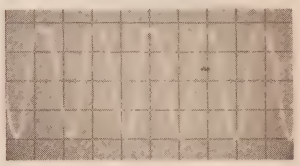
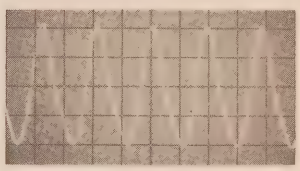
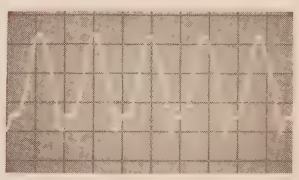
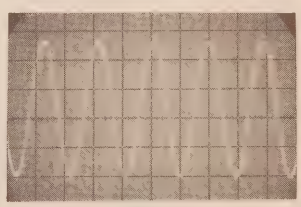
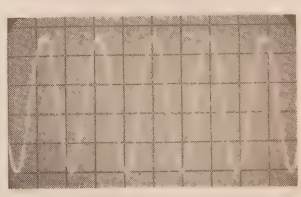
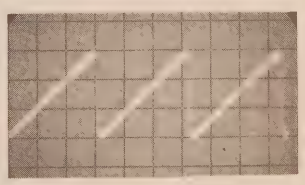
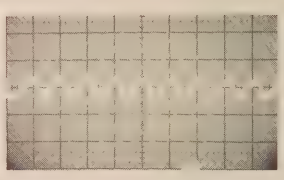
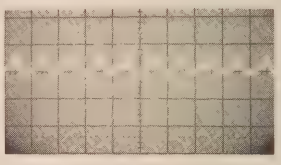
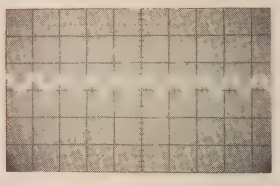
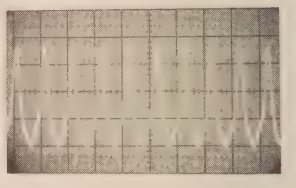
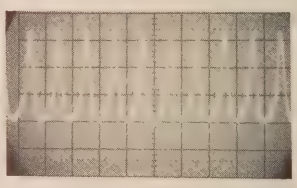
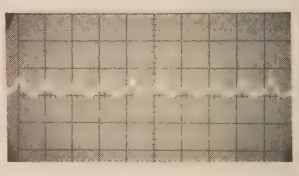
Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
10MC OSC/DISC. ASSEMBLY (cont.)			
18 STABILIZATION . . . . . PRE STAB BAL	Grid, A15A1V1	2 V/cm .05 μs/cm	
19	Base, A15A1Q1	2 V/cm .05 μs/cm	
20	Collector, A15A1Q1	5 V/cm .05 μs/cm	
21	Output at J26 (10-Mc output to Sampler A23)	2 V/cm .05 μs/cm	
22	A15TP1, DISC. INPUT	1 V/cm .05 μs/cm	
23	Plate, A15A1V2	5 V/cm .05 μs/cm	
24 STABILIZATION . . . . . STABILIZED	Junction, A15A1C24 and A15A1R12	5 V/cm 10 ms/cm	

Table 7-1. Waveform Chart, Model 8551B (cont.)

	Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
	PULSE AMPLIFIER ASSEMBLY			
25	851/852 SWEEP TIME . . . . . 3 MILLISEC/CM SWEEP TIME VERNIER . . . . . CAL SYNC . . . . . INT 8551 SPECTRUM WIDTH . . . . . 1 MC/CM SPECTRUM WIDTH VERNIER . . CAL FREQUENCY(GC) . . . . . .01 - 2 TUNE . . . . . 2 Gc on LO Dial and set for FINE tuning STABILIZATION . . . . . STABILIZED	Collector, A15A4Q1	50 mV/cm 0.1 μs/cm	
26		Collector, A15A4Q2	0.5 V/cm 0.1 μs/cm	
27		Collector, A15A4Q3	0.5 V/cm 0.1 μs/cm	
28		Collector, A15A4Q4	1 V/cm 0.1 μs/cm	
29		Emitter, A15A4A5	1 V/cm 0.1 μs/cm	
30		Emitter, A15A4Q6	0.5 V/cm 0.1 μs/cm	

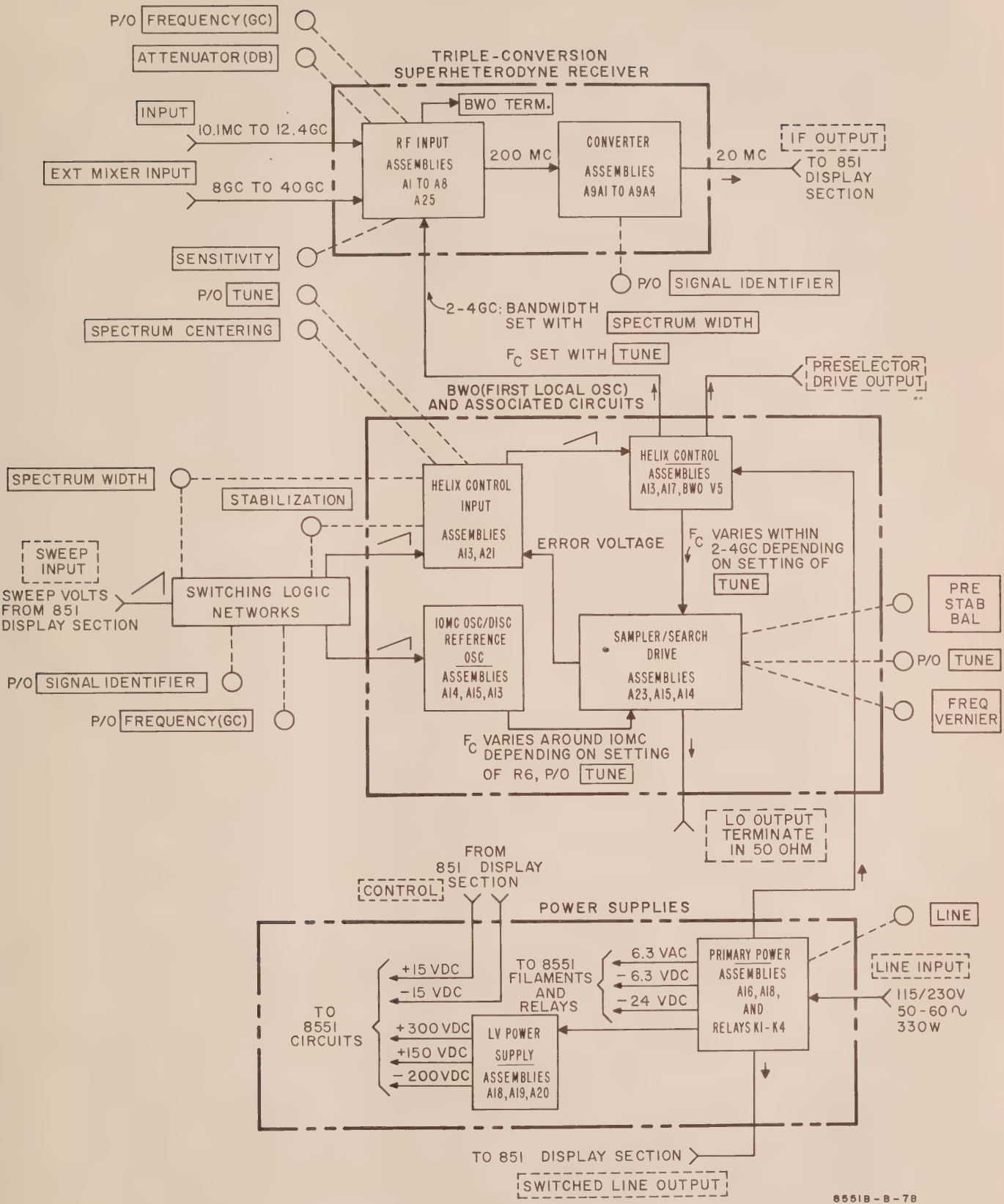


Figure 7-1. Model 8551B RF Section, Block Diagram

Table 7-2. Chassis Parts Locator

Circuit Desig.	Function	Location (Fig. No.)	
		Photograph	Schematic
A1	Input Attenuator Assembly	7-3,7-13	7-15
A2	Mixer/Coupler Assembly	7-6,7-14	7-15
A3	Coax Mixer Assembly	7-7,5-26	7-15
A4K1	Coax Switch	7-6	7-15
A5	2GC IF Amplifier Assembly	7-6,5-27	7-15
A6	Harmonic Generator Assembly	7-6,6-6	7-15
A7	2GC Mixer Assembly	7-6,6-7	7-15
A8K1	Coax Switch	7-6	7-15
A9	Converter Assembly	7-2,7-19	7-18
A10	SIGNAL IDENTIFIER Switch Assembly	7-4,7-10	7-18,7-21
A11	FREQUENCY(GC) Switch	7-4,7-11	7-15,7-21
A12	SPECTRUM WIDTH Switch	7-4,7-12	7-21,7-32
A13	Helix Control Assembly	7-3,7-30	7-26,7-32,7-35
A14	Search Drive Assembly	7-3,7-27	7-26,7-29
A15	Lock Assembly	7-2,7-22	7-26,7-29
A16	HV Time Delay Assembly	7-3,7-33	7-35,7-38,7-41
A17	Helix Voltage Shaper Assembly	7-3,7-34	7-35
A18	LV Rectifier Assembly	7-3,7-37	7-38,7-41
A19	LV Power Supply	7-2,7-39	7-41
A20	LV Series Regulator	7-2,7-42	7-41
A21	Meter Board Assembly	7-4,7-8	7-21,7-32
A22K1	Coax Switch	7-4	7-15
A23	Sampler Assembly	7-23	7-29
A24	STABILIZATION Switch	7-4	7-21,7-32
A25	BIAS Generator Assembly	7-3,7-45	7-15
A24R1	PRE STAB BAL on STABILIZATION Switch	7-4	7-29
AT1	Circulator (Isolator)	Bot. of Instr.	7-29
AT2	Attenuator AT2	7-3,7-13	7-15
C3 C4 C5 C6	P/O Gain Compensating Switch in BWO-stabilizing circuit (in the line between Pulse Amplifier output and Search Oscillator input)	7-4	7-29
C7	P/O filter in HV supply	7-5	7-35
C8	P/O filter in HV supply	7-5	7-35
C9 C10	P/O filter in regulated screen-voltage supply for Series Regulators	7-9	7-35
C12	P/O filter in Series Regulator output	7-5	7-35
C14	P/O filter in regulated + 300-V supply	7-9	7-41
C15	P/O filter in regulated + 150-V supply	7-9	7-41
C16	P/O filter in regulated -200-V supply	7-9	7-41
C17	Filter in input to A18 LV Rectifier Series Regulators	7-5	7-38
C18,C19	Unassigned		

Table 7-2. Chassis Parts Locator (cont.)

Circuit Desig.	Function	Location (Fig. No.)	
		Photograph	Schematic
C20	Holds Helix Overload Relay K4 operated until input power is turned off	7-5	7-35
C26, C27	Transient suppressors		7-38
DS1	STANDBY lamp	7-4	7-38
DS2	ON lamp	7-4	
DS3	REDUCE SPECTRUM WIDTH lamp (Rear of front panel, under Frequency Scales dial)	7-4	7-21
DS4-DS8	Illuminates Frequency dial	7-4	7-38
DS9	SPEC WIDTH UNCAL lamp	7-4	7-38
FL1	Low-pass Filter in line from 2 Gc Mixer Assembly A7	7-6	7-15
J1	INPUT, Front Panel	1-1	7-15
J2	EXT MIXER INPUT, Front Panel	1-1	7-15
J3	2 GC OUTPUT, Rear Panel	2-1	7-15
J4	2 GC IF INPUT, Rear Panel	2-1	7-15
J5	200 MHZ OUTPUT, Rear Panel	2-1	7-15
J6	200 MHZ INPUT, Rear Panel	2-1	7-18
J7	IF OUTPUT, Rear Panel	2-1	7-18
J8	SWEEP INPUT, Rear Panel	2-1	7-21
J9	CONTROL, Rear Panel	2-1	7-21
J10	LO OUTPUT TERMINATE in 50 OHM, Rear Panel	2-1	7-29
J11	Receptacle for BWO termination R51	7-6,7-14	7-15
J12	On Mixer/Coupler Assembly A2, input for 200-Mc line	7-6,7-14	7-15
J13	On Mixer/Coupler Assembly A2, 200-MC output, receives Cable W7	7-14	7-14
J14	On Coax Mixer Assembly A3; receives Cable W1	7-7	7-15
J15	P/O Coax Switch A4K1; receives coax input 2 GC line (Cable W1)	7-6	7-15
J16	P/O Coax Switch A4K1; receives waveguide input 2 GC line (Cable W21)	7-6	7-15
J17	Coax Switch A4K1 output; receives Cable W22 from 2 GC IF Ampl A5	7-6	7-15
J18	2 GC input, 2 GC Mixer A7, receives Cable W3 from 2 GC IF INPUT	7-6	7-15
J19	1800 MC input, 2 GC Mixer A7; receives Cable W24 from Harmonic Generator A6		7-15
J20	200 MC output, 2 GC Mixer A7; receives Cable W4 from Low-Pass Filter FL1		7-15
J21	P/O Coax Switch A8K1; receives Cable W5 from Low-Pass Filter FL1	7-6	7-15
J22	P/O Coax Switch A8K1; receives Cable W7 from Mixer/Coupler A2	7-6	7-15
J23	Coax Switch A8K1 output; receives Cable W25 outgoing to 200 MHZ OUTPUT, J5	7-6	7-15
J24	Input to Converter A9; receives Cable W26 from 200 MHZ INPUT, J6	5-6	7-18
J25	On Converter A9; 180 MC output; receives Cable W23 from Harmonic Generator A6	7-19	7-18

Table 7-2. Chassis Parts Locator (cont.)

Circuit Desig.	Function	Location (Fig. No.)	
		Photograph	Schematic
J26	On Lock Assembly A15; 10-MC reference output; receives Cable W10 outgoing to Sampler A23	7-23	7-26
J27	On Lock Assembly A15; Discriminator output; receives Cable W28 from Helix Control Assembly A13	7-23	7-26
J28	On Sampler A23; receives Cable W10 from 10-MC Reference Oscillator in Lock Assembly A15	7-23	7-29
J29	On Lock Assembly A15; Pulse Ampl input; connects to P1 on Sampler Assembly A23	7-23	7-29
J30	On Lock Assembly A15; Pulse Ampl output; receives Cable W31 from Search Drive Assembly A14	7-23	7-29
J31	On BWO V5; receives Cable W18 RF output to Coax Mixer A3	7-7	7-35
J32	On BWO V5; receives Cable W32 RF output to Circulator AT1	7-7	7-35
J33	On Converter A9; 20 MC output; receives Cable W27 outgoing to IF OUTPUT, J7		7-18
J34	SWITCHED LINE OUTPUT; line voltage connection -- 851 power cable plugs in here	2-1	7-38
J36	On Coax Switch A22K1; receives Cable W34 from Input Attenuator Assembly A1	7-7	7-15
J37	On Coax Switch A22K1; receives Cable W14 outgoing to Coax Mixer Assembly A3 (2 GC mixer) via Attenuator AT2	7-7	7-15
J38	On Coax Switch A22K1; receives Cable W15 outgoing to Mixer/ Coupler Assembly A2 (200 Mc mixer)	7-7	7-15
J39	On Mixer/Coupler Assembly A2, BWO RF input receives Cable W19 on Coax Mixer Assembly A3	7-6	7-15
J40	On Coax Mixer Assembly A3, RF input; connects to 3 dB Attenuator AT2	7-7	7-15
J41	On 2 Gc IF Amplifier; receives Cable W22 from Coax Switch A4K1	7-6	7-15
K1	Delay Relay in HV turn-on circuit	7-5	7-38
K2	HV Relay; closes line voltage to HV Transformer T3	7-5	7-38
K3	Filament Over Voltage Relay K3; behind A16 Board	7-5	7-38
K4	Helix HV Overload Relay K4	7-5	7-35
M1	OSC TRACK BALANCE meter	7-4	7-32
MP8	Tie Point	7-37	not shown
MP9	Tie Point. Under right-side cover, behind A17 Helix Voltage Shaper Assembly. Frequency Scales		not shown
Q1,Q2, Q3	Series Regulators, LV Rectifier Assembly	7-37	7-38
Q4	Emitter Follower, Regulator Control, LV Rectifier Assembly	7-37	7-38
Q5,Q6	Temperature Compensators, LV Rectifier Assembly	7-37	7-38
R3	SENSITIVITY control	7-4	7-15
R4	SPECTRUM CENTERING adjust	7-4	7-32
R5	P/O TUNE	7-4	7-32
R6	P/O TUNE	7-4	7-26
R7	P/O TUNE	7-4	7-26
R9-R15	P/O Gain Compensating Switch S4 in BWO-stabilizing circuit	7-28	7-29

Table 7-2. Chassis Parts Locator (cont.)

Circuit Desig.	Function	Location (Fig. No.)	
		Photograph	Schematic
R18-R20	P/O regulated screen-voltage supply for Series Regulators V1,V2	7-9	7-35
R22	P/O plate load, Power Amplifier A13V8	7-5	7-35
R40	P/O filter, regulated + 300-V supply	7-9	7-41
R41	P/O filter, regulated + 150-V supply	7-9	7-41
R42	P/O filter, regulated -200-V supply	7-9	7-41
R43	Dropping resistor, STANDBY lamp circuit	7-9	7-41
R44	Dropping resistor, ON lamp circuit	7-4	7-38
R45	Unassigned		
R47	P/O Relay K3 holding circuit	7-5	7-38
R49	Dropping resistor, REDUCE SPEC WIDTH lamp circuit	7-4	7-21
R50	BWO 50-ohm termination; plugs into LO OUTPUT - TERMINATE IN 50 OHM on rear panel	7-6	7-29
R51	BWO internal 50-ohm termination	7-2	7-15
R52	P/O of holding circuit for Relay K3	7-5	7-38
R53,R54	Voltage divider; PRESELECTOR DRIVE OUTPUT		7-35
R55	SIG. IDENT CAL potentiometer	7-4	7-18
R56	FREQ. VERNIER potentiometer	7-4	7-26
R57	STAB. TUNE potentiometer	7-4	7-26
R58	Dropping resistor, SPEC WIDTH UNCAL lamp circuit	7-4	7-21
R59	100 MC/CM ADJ potentiometer	7-7	7-37
R60	200 MC/CM ADJ potentiometer	7-7	7-37
R61	EXT MIXER INPUT; 50-ohm termination	7-7	7-15
S2	LINE switch	7-4	7-38
S3	Line Voltage switch 115/230	2-1	7-38
S4	Gain Compensating switch	7-4	7-29
T1	Filament Supply Transformer	7-5	7-38
T2	LV Transformer	7-5	7-38,7-41
T3	HV Transformer	7-5	7-38,7-35
TB1	LV Power Supply distribution	7-3,7-5	not shown
TB2	BWO Power Supply distribution	7-3,7-5	not shown
TP1	Samples sweep voltage coming in from Display Section	7-4	7-21
TP2	Samples sweep voltage after initial attenuation by FREQUENCY (GC) (range) switch	7-4	7-21
TP3	Samples sweep voltage after initial attenuation by SPECTRUM WIDTH	7-4	7-21
TP4	Samples sweep voltage after final attenuation by FREQUENCY(GC)	7-4	7-21
V1	Series Regulator	7-5	7-35
V2	Series Regulator	7-5	7-35
W1	Cable between Coax Mixer A3 and Coax Switch A4	7-6,7-7	7-15
W2	Cable (external) between 2 GC OUTPUT and 2 GC IF INPUT	7-6	7-15
W3	Cable between 2 GC IF INPUT and 2 GC Mixer A7	7-6	7-15
W4	Cable between 2 GC Mixer A7 and Low-pass Filter FL1	7-6	7-15

Table 7-2. Chassis Parts Locator (cont.)

Circuit Desig.	Function	Location (Fig. No.)	
		Photograph	Schematic
W5	Cable between Low-pass Filter FL1 and Coax Switch A8	7-6	7-15
W6	Cable (external) between 200 MHZ OUTPUT and INPUT	7-6	not shown
W7	Cable between Mixer/Coupler A2 and Coax Switch A8	7-6	7-15
W8	Cable line-voltage input	2-1	7-38
W9	Cable (external) between 8551 CONTROL and 851 CONTROL connectors	2-1	not shown
W10	Cable between 10-MC Reference Osc (Lock Assembly A15) and Sample A23	7-23	7-26,7-29
W11	Cable (external) between 8551 IF OUTPUT and 851 IF INPUT	2-1	not shown
W12	Cable (external) between 851 SWEEP OUTPUT and 8551 SWEEP INPUT	2-1	not shown
W13	Cable from INPUT (J1) to Input Attenuator A1 (ATTENUATOR (DB) switch)	7-7,7-13	7-15
W14	Cable from Coax Mixer Assembly A3 (2 GC mixer); connects to Coax Switch A22	7-7,7-13	7-15
W15	Cable between Coax Switch A22 and Mixer/Coupler Assembly A2 (200 MC mixer)	7-6,7-13	7-15
W16	Cable from J12 into Mixer/Coupler A2	7-6	7-15
W17	Cable from EXT MIXER INPUT (J2) to Mixer/Coupler A2	7-7,7-14	7-15
W18	Cable from BWO to Coax Mixer A3	7-7,7-14	7-15,7-35
W19	Cable from Coax Mixer A3 to Mixer/Coupler A2	7-7,7-14	7-15
W20	Cable from Mixer/Coupler A2 to J11 which receives BWO 50-ohm termination	7-6,7-14	7-15
W21	Cable from Mixer/Coupler A2 to Coax Switch A4	7-6,7-14	7-15
W22	Cable from Coax Switch A4 to 2 GC IF Amplifier A5	7-6	7-15
W23	Cable from Converter A9 to Harmonic Generator A6	7-6	7-15,7-18
W24	Cable from Harmonic Generator A6 to 2 GC Mixer A7	7-6	7-15
W25	Cable from Coax Switch A8 to 200 MHZ OUTPUT (J5)	7-6	7-15
W26	Cable from 200 MHZ INPUT to Converter A9	7-6	7-18
W27	Cable from Converter A9 to IF OUTPUT (J7)	7-6	7-18
W28	Cable from Discriminator in Lock Assembly A15 to Differential Amplifier A13V5 in Helix Control Assembly A13	5-15	7-26
W29	Cable from Circulator AT1 to Sampler A23	7-23	7-29
W30	Cable from Sampler A23 to LO OUTPUT - TERMINATE IN 50 OHM (J10, BWO termination Lock Assembly)	7-23	7-29
W31	Cable from Search Drive Assembly A14 to Lock Assembly A15	5-15	7-29
W32	Cable between BWO V5 and Circulator AT1	7-7	7-35,7-29
W33	Cable from A13 Board to PRESELECTOR DRIVE OUTPUT		7-35
W34	Cable from output of Input Attenuator Assembly A1; connects to J36, input to Coax Switch A22	7-13	7-15
W35	Cable from Coax Mixer A3 to Mixer/Coupler A2	7-6	7-15
Z1	Line Filter Assembly in line-voltage input	7-5	7-38
Z2	RF Filter in 2 GC Amplifier input		7-15

Table 7-3. Connections, A14 Search Drive Assembly Board

Conn.	Pin No.	Mates with	Color Code	Connection
A14A	1	XA14A	wht-yel-red, 2 leads	+15 V dc, from 851 via TB1
A14A	2	XA14A	wht**	From A24R1, PRE STAB BAL control
A14A	3	XA14A	blk	To A24R1
A14A	4	XA14A	blk	Chassis ground*
A14A	5	XA14A	red**	From adjustable contact on A24R1, PRE STAB BAL control
A14A	6	XA14A	yel-grn, coax	To Gain-Compensating Switch S4
A14A	7	XA14A	blk-blk, coax	From Pulse Amplifier A15A4 output
A14A	8	XA14A	yel-blu, coax	Stabilizing signal to Helix Control Differential Amplifier A13V1 via A21R1 and STABILIZATION
A14A	9	XA14A	wht-yel-vio, 2 leads	-15 V dc from 851 via TB1
A14A	10	XA14A	blk, 2 leads	Chassis ground*
A14A	11	XA14A	wht-blu connex (E)‡, coax	Sweep voltage from 851 via 8551 switching logic network
A14A	12	XA14A	wht-brn, 2 leads	-6.3 V dc, from LV Rect Assembly A18, via TB1
A14A	13	XA14A	wht-red-blk, 2 leads	+150 V dc, from LV Power Supply A19, via TB1
A14A	14	XA14A	red	To R6, P/O TUNE
A14A	15	XA14A	wht-vio, 2 leads	-200 V dc, from LV Power Supply A19 via TB1
A14B	1	XA14B		Unoccupied
A14B	2	XA14B	blk	From R7, P/O TUNE
A14B	3	XA14B		Unoccupied
A14B	4	XA14B		To R7, P/O TUNE
A14B	5	XA14B		Unoccupied
A14B	6	XA14B	wht-red	+300 V dc, from LV Power Supply A19 via TB1

* From tie point near capacitor C14
** Shielded cable, coded yellow
‡ Designation used on schematic for this connection

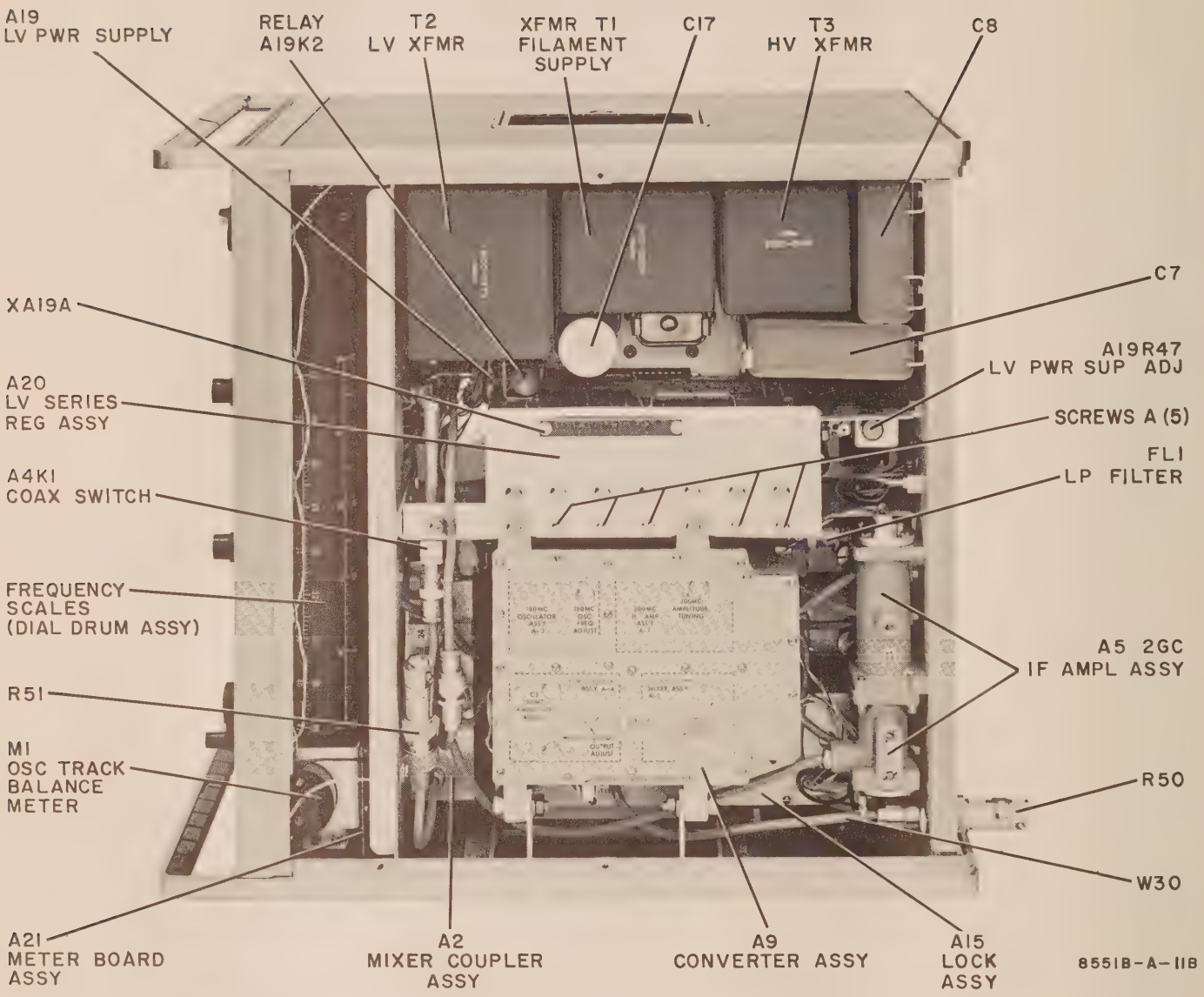


Figure 7-2. Top View, Cover Removed

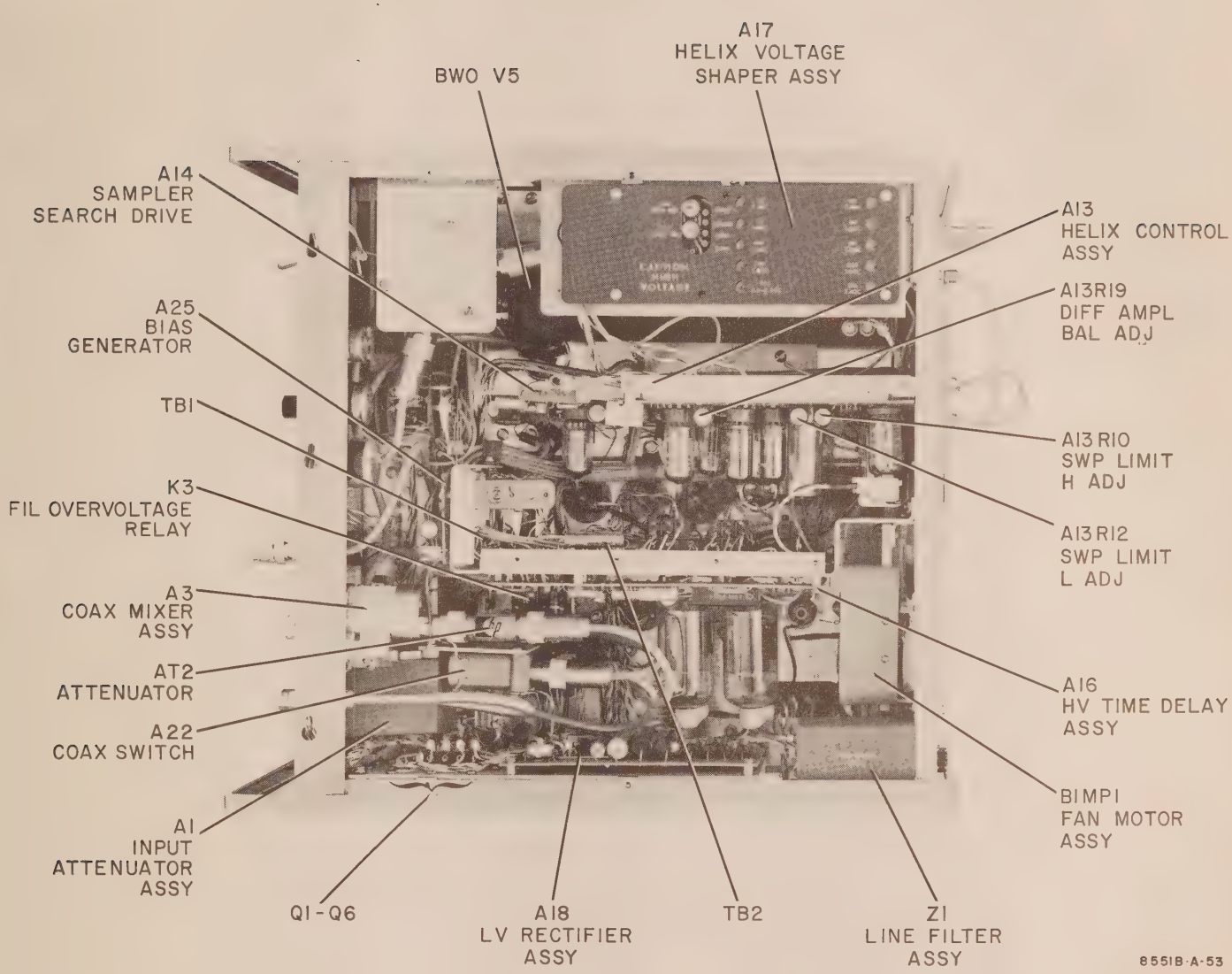


Figure 7-3. Bottom View, Cover Removed

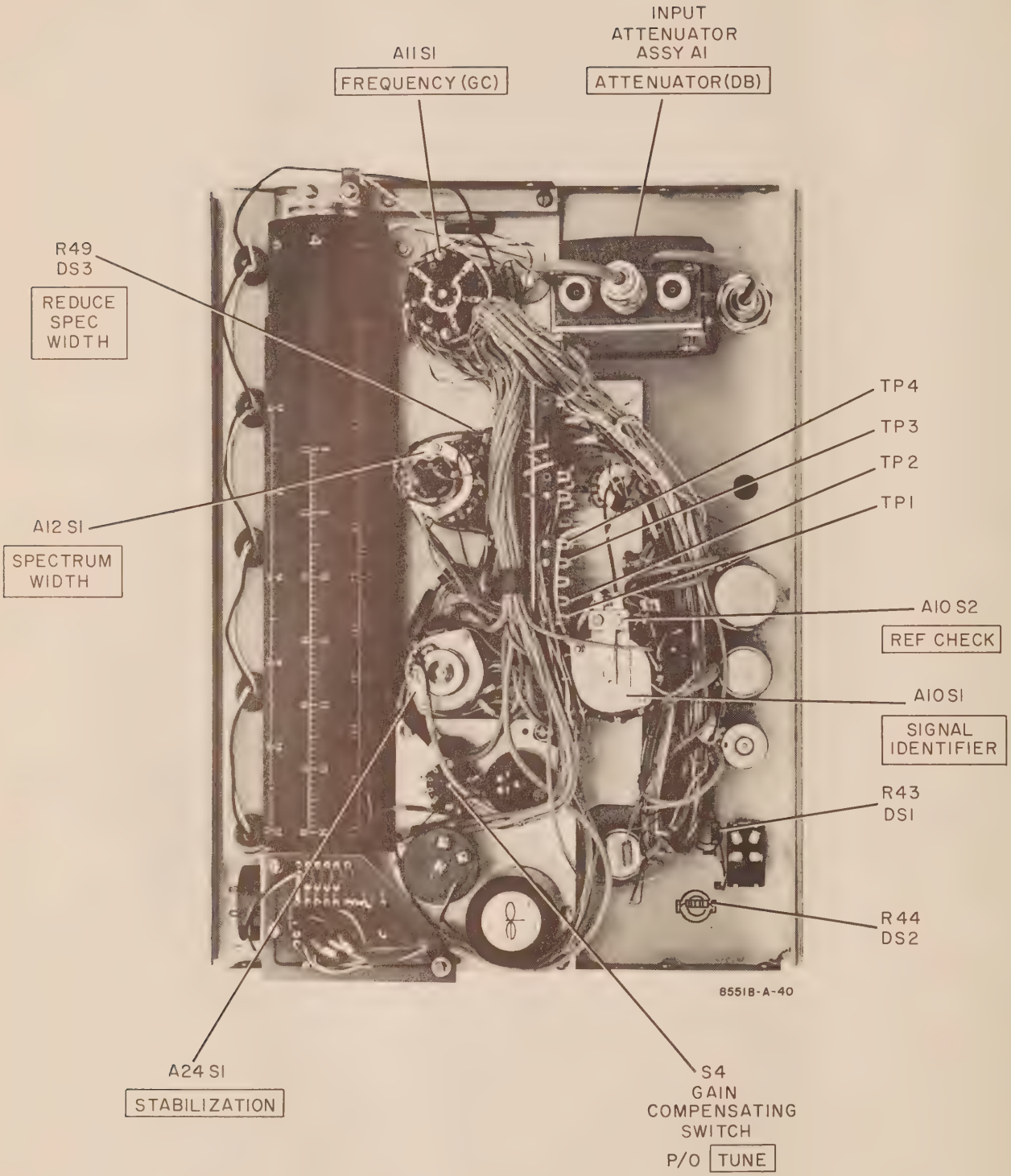


Figure 7-4. Rear of Front Panel (sheet 1 of 2)

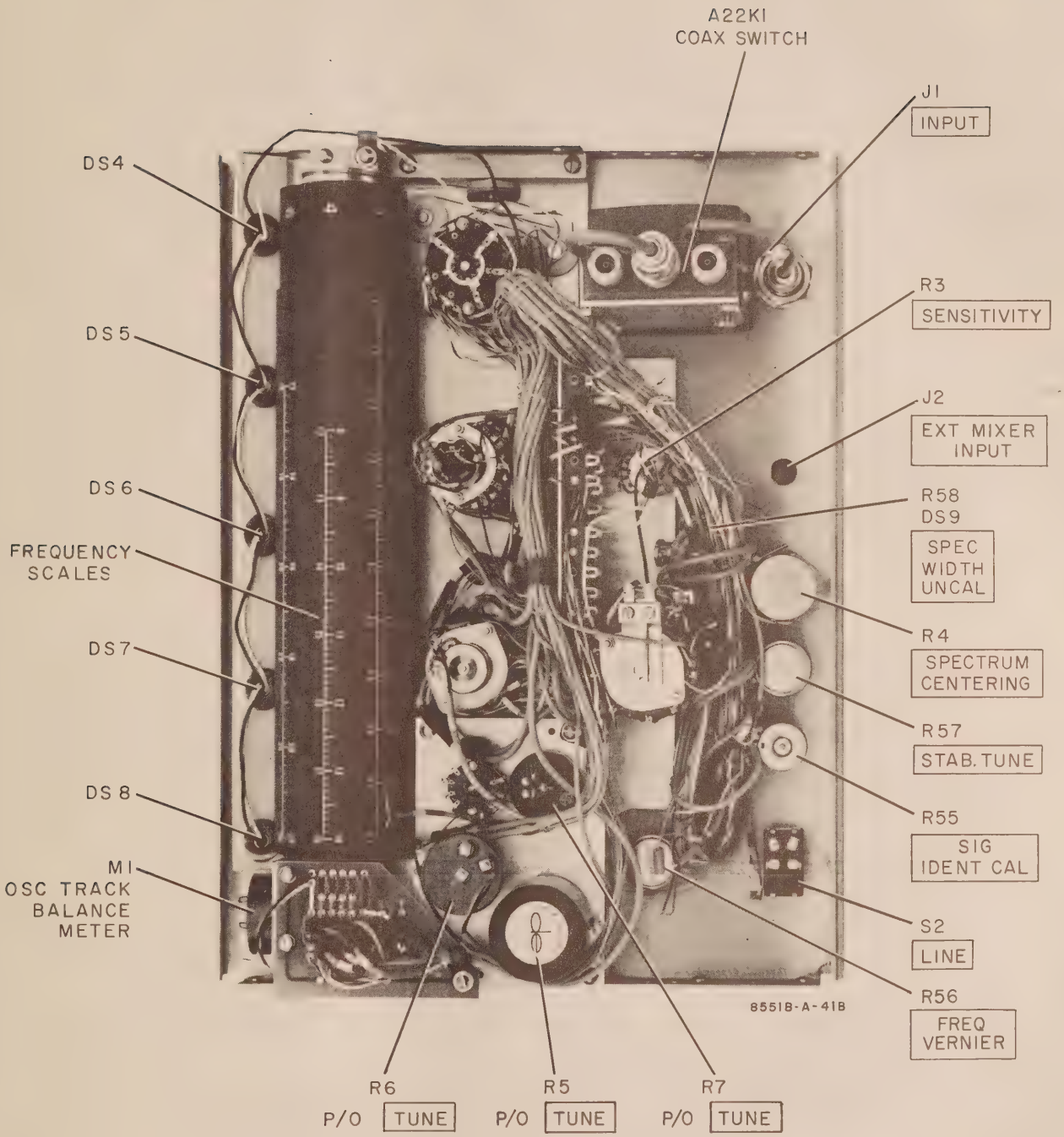


Figure 7-4. Rear of Front Panel (sheet 2 of 2)

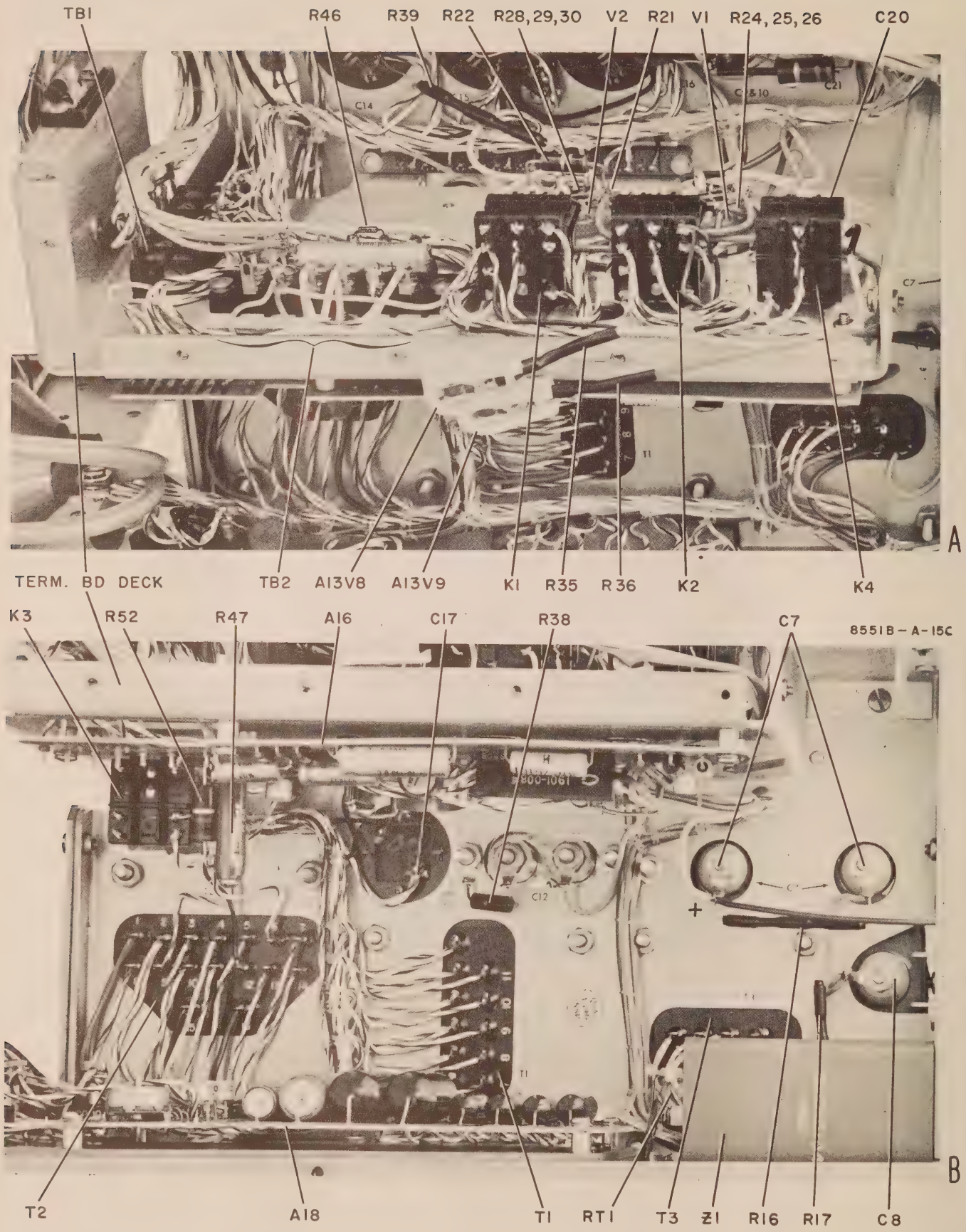


Figure 7-5. Interior Views as Seen from Bottom of 8551, Component Identification

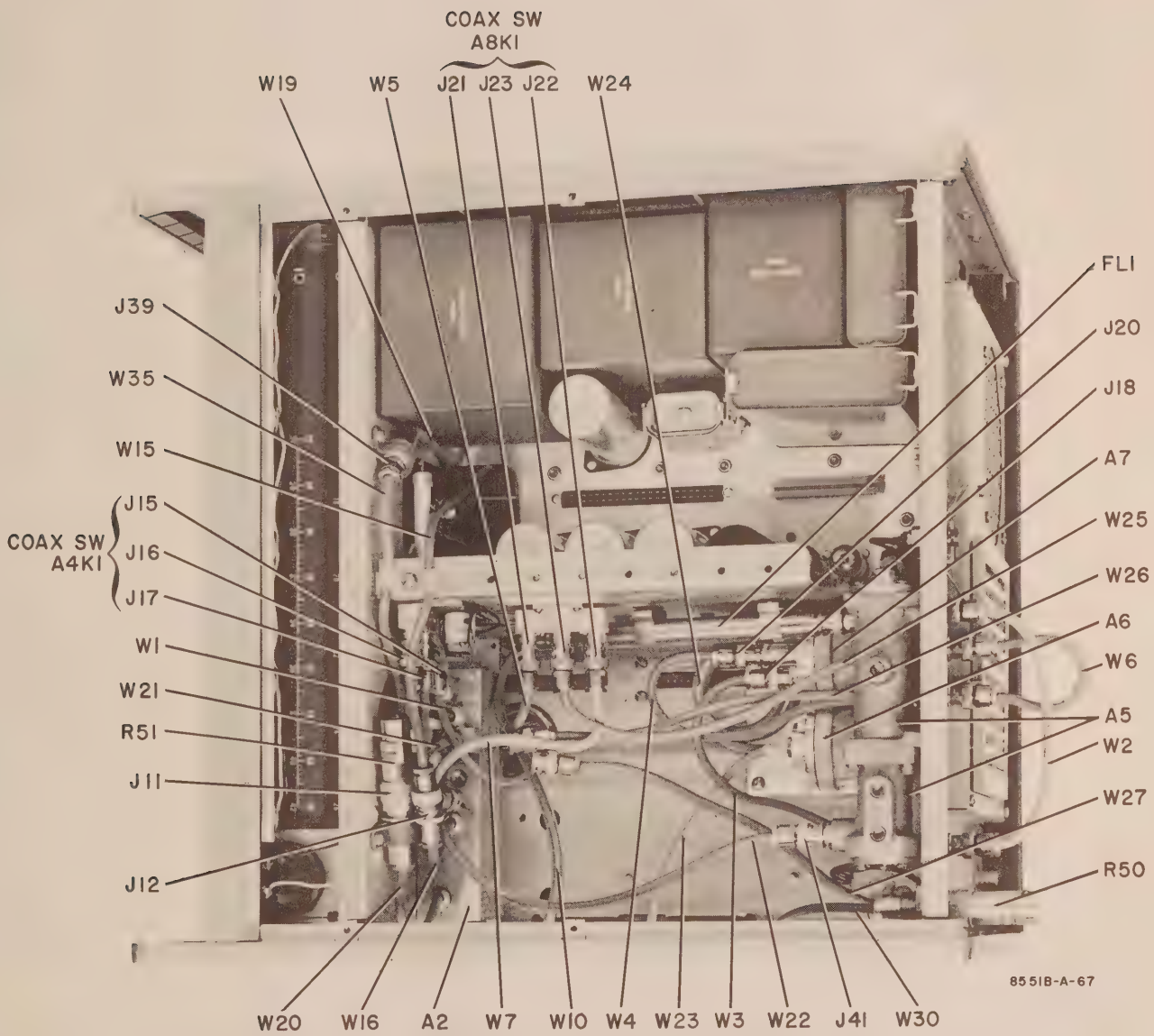


Figure 7-6. Top View to Show Cabling, Converter and Lock Assemblies Removed

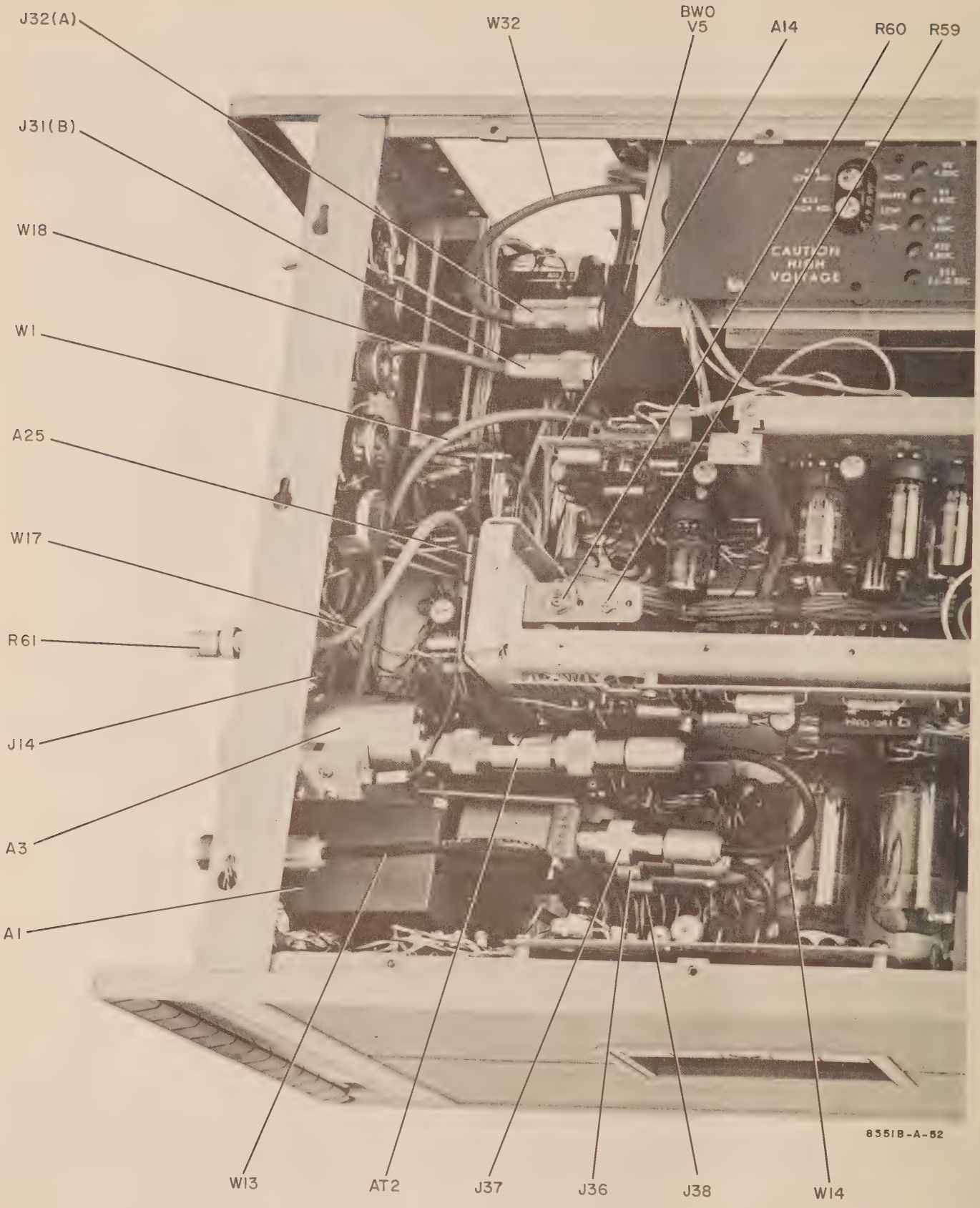


Figure 7-7. Portion of Bottom of 8551, Cabling and Component Identification

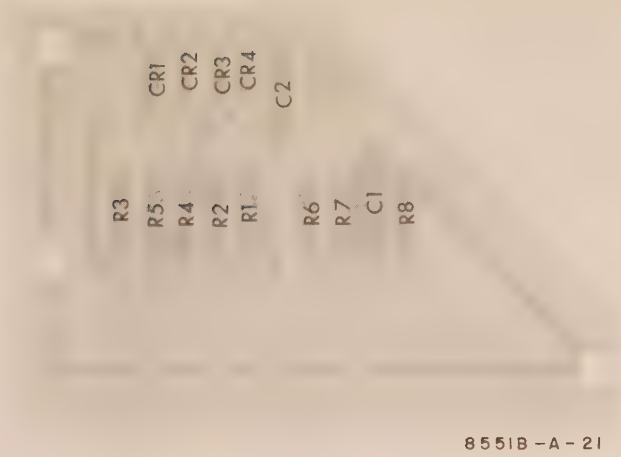


Figure 7-8. Meter Board Assembly A21, Component Identification (Prefix all designations with A21)

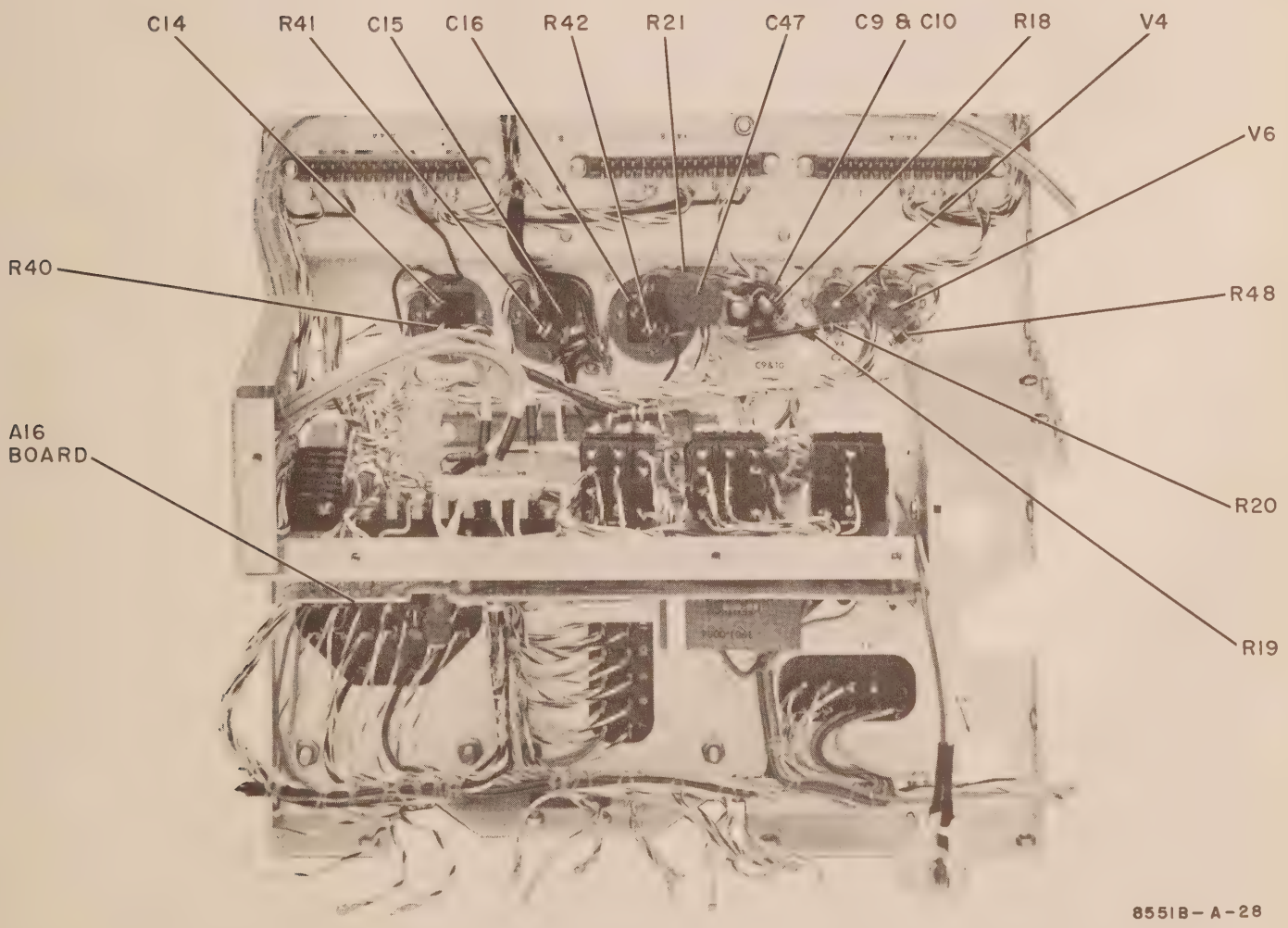


Figure 7-9. Interior of 8551, Bottom View, Component Identification

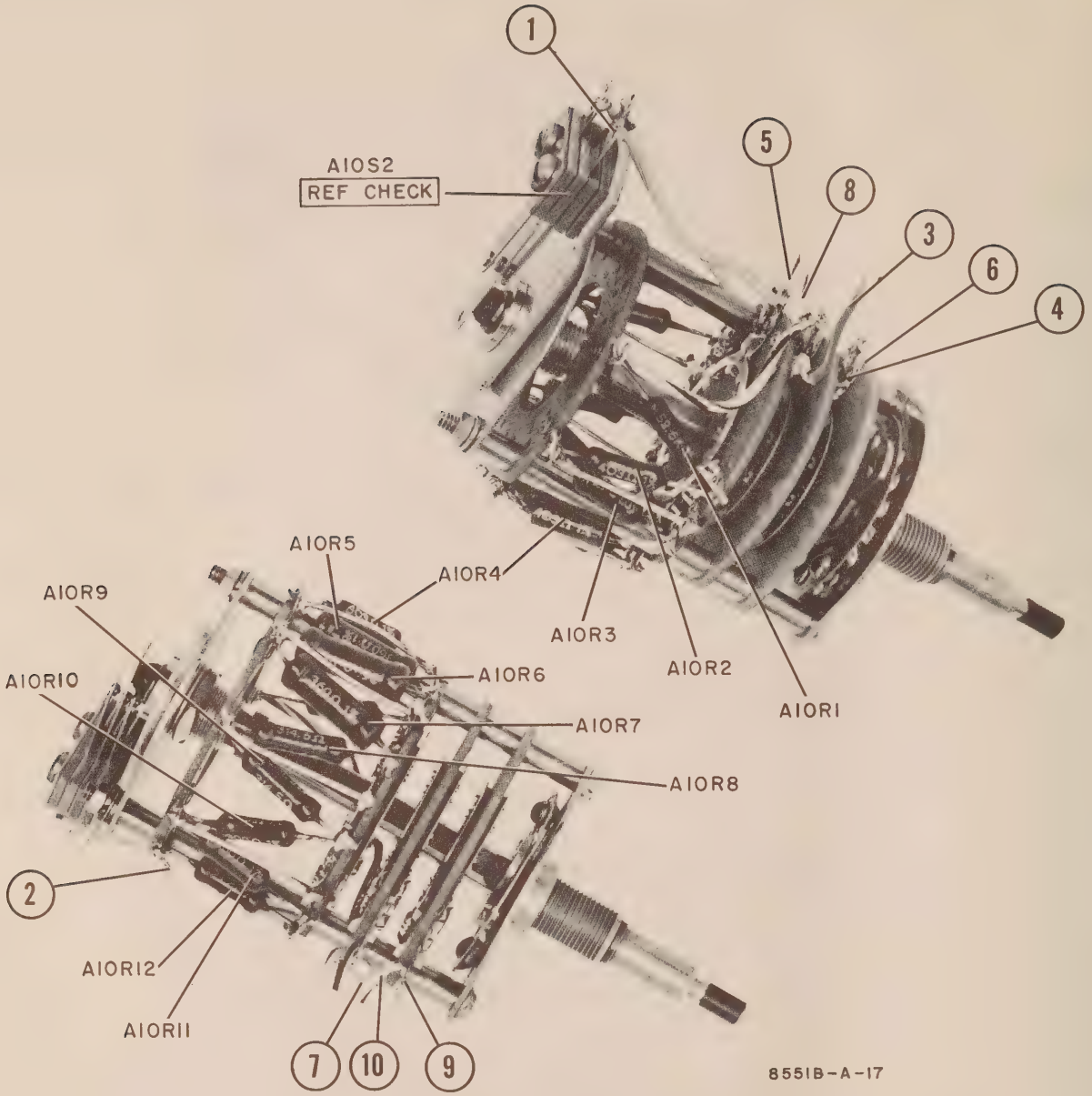


Figure 7-10. SIGNAL IDENTIFIER Switch A10

Table 7-4. Connections, SIGNAL IDENTIFIER Switch A10

Term. No.	Color Code	Connection
1	wht	To contactor 3R-17; connects to A10R1-A10R12
2	wht	To SIG IDENT CAL (R55)
3	red	Lead to SPEC WIDTH UNCAL lamp DS9
4	wht-yel-vio	To contactor 3R-2 on FREQUENCY(GC) switch
5	wht-grn	To: 1) TP3, 2) contactor 1R-3 on STABILIZATION switch
6	wht-yel-grn	To: 1) TP4, 2) contactor 3F-1.5 on SPECTRUM WIDTH switch
7	wht-blu-vio	To contact 1F-7.5 on FREQUENCY(GC) switch
8	wht-brn	To: 1) TP2, 2) contactor 1F-2.5 on STABILIZATION switch
9	wht-blu-gray	To IF-2 on FREQUENCY(GC) switch
10	wht	To: 1) TP1, 2) SWEEP INPUT Connector J8

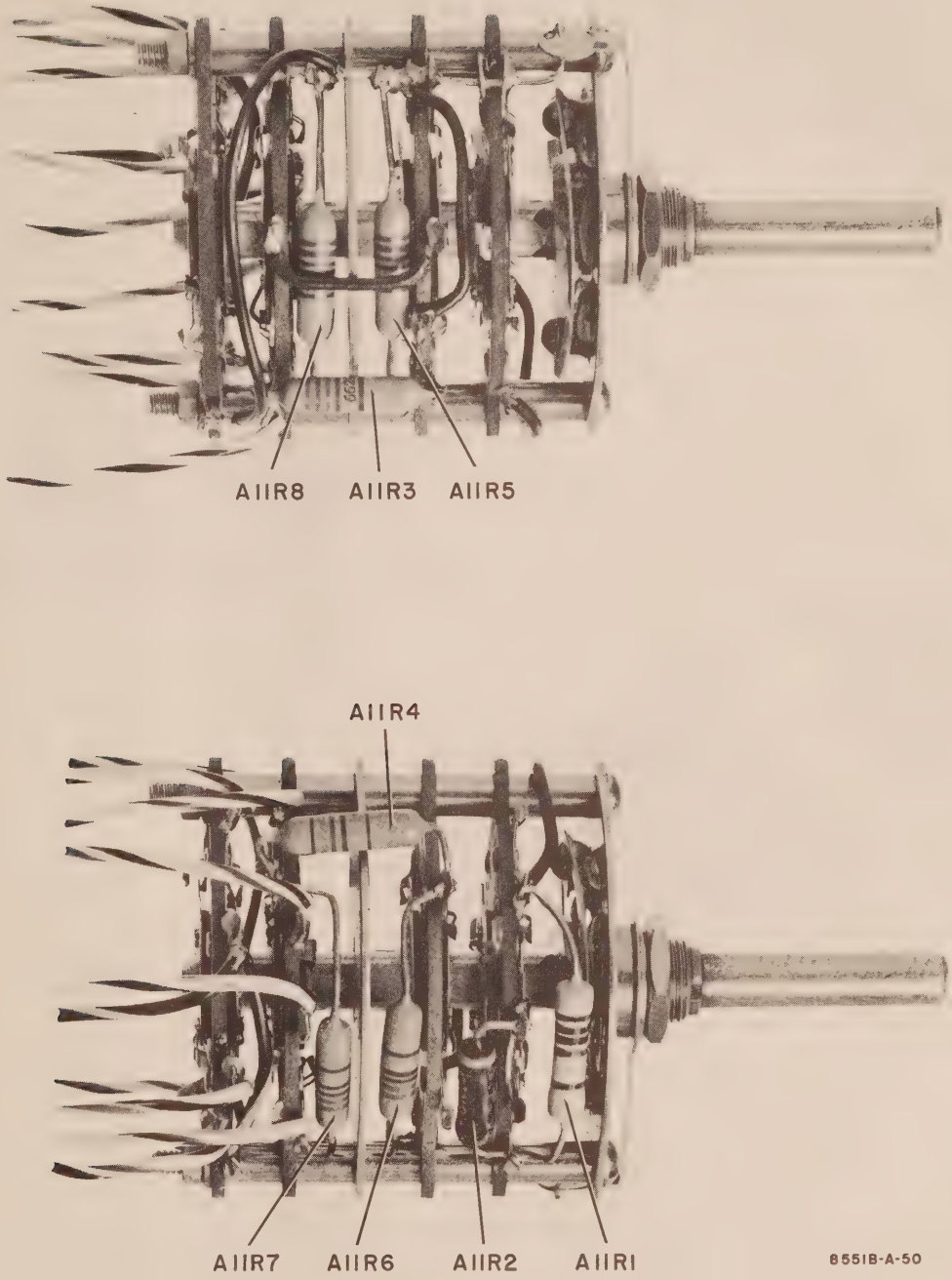


Figure 7-11. FREQUENCY(GC) Switch A11

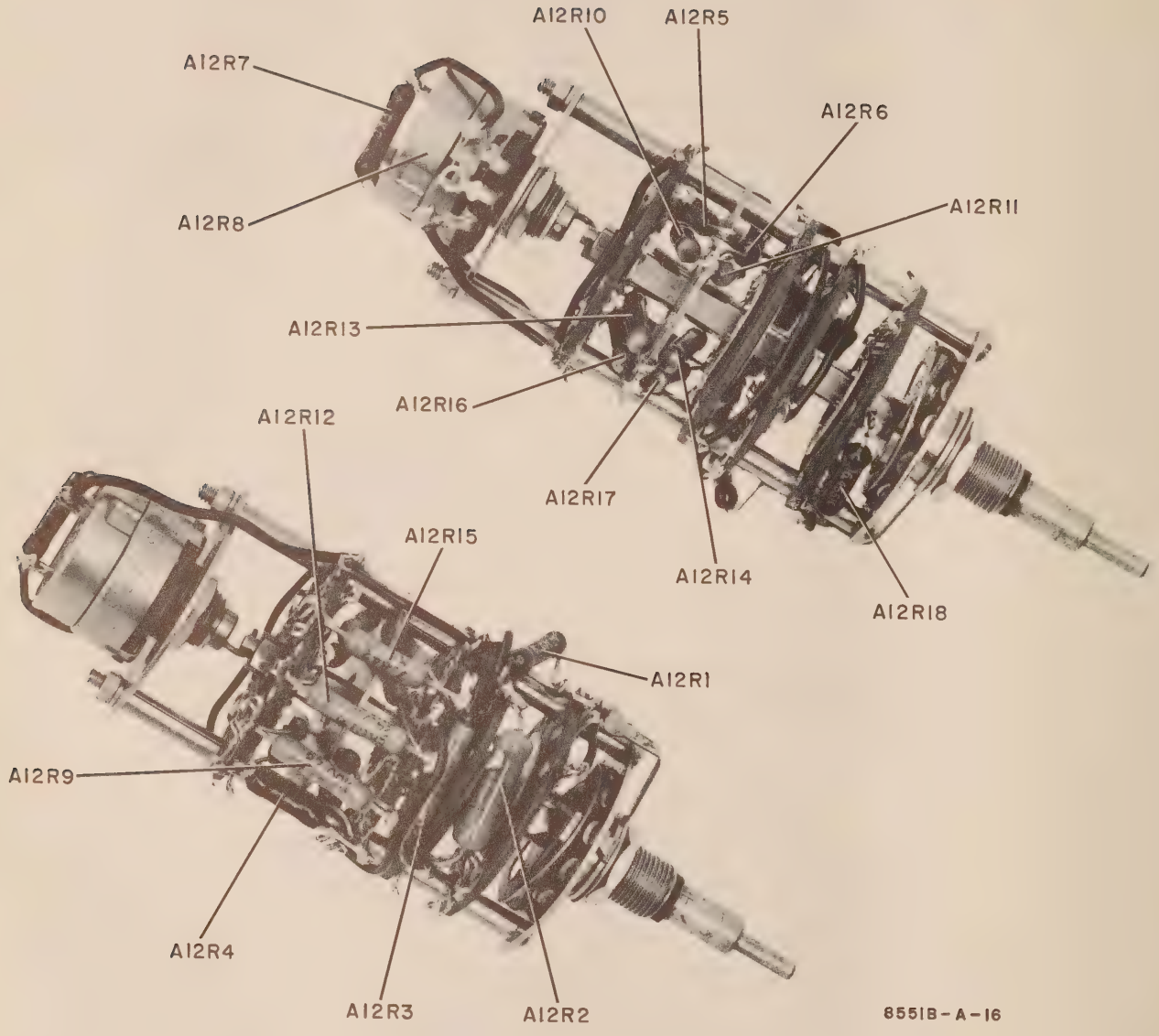


Figure 7-12. SPECTRUM WIDTH Switch A12

Table 7-5. Symbols Used on Schematic Diagrams

	=	screwdriver adjust
	=	panel control
	=	front panel designation
	=	rear panel designation
	=	etched circuit border
	=	signal path
	=	feedback path
*	=	factory-selected value; see Table 5-39 for basis of selection. In some cases, part may be omitted.
P/O	=	part of
	=	test point, see circuit board†
	=	waveform, see Table 7-1.
 CW	=	movable contact position with adjustment turned max cw
	=	breakdown (voltage regulator) diode
	=	thermistor
	=	circulator (used as isolator)
	=	coaxial directional coupler
	=	tuneable cavity

† See Table 5-15 for cross-index between Assemblies and circuit boards.

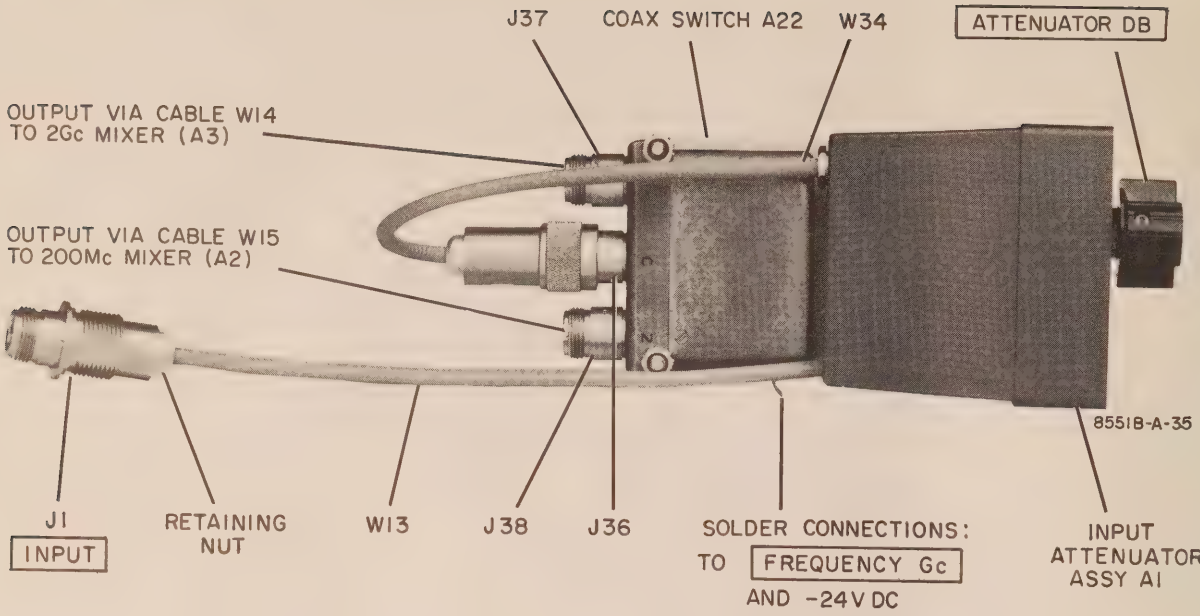


Figure 7-13. Input Attenuator Assembly A1

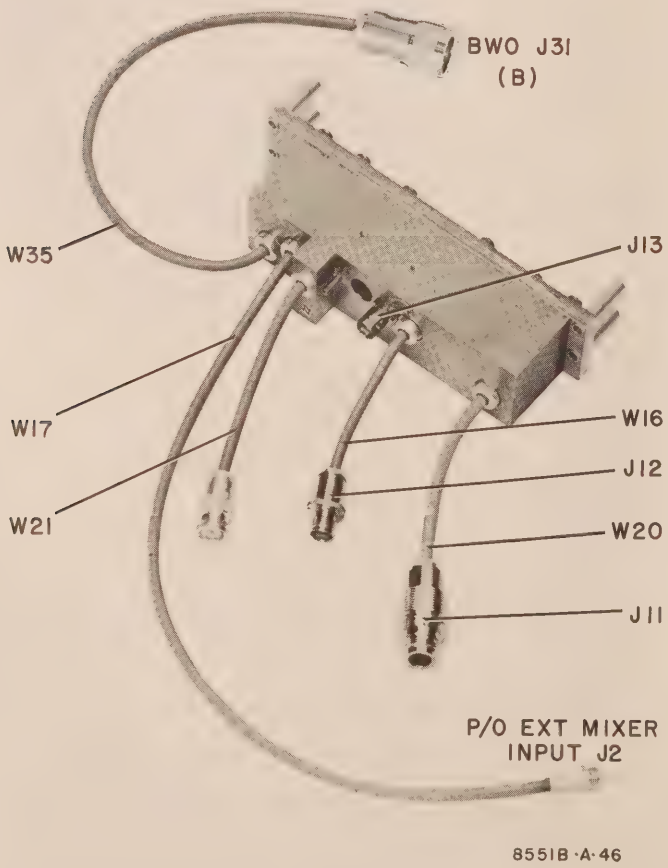


Figure 7-14. Mixer/Coupler Assembly A2

Figure 7-15
RF INPUT SCHEMATIC, 8551B

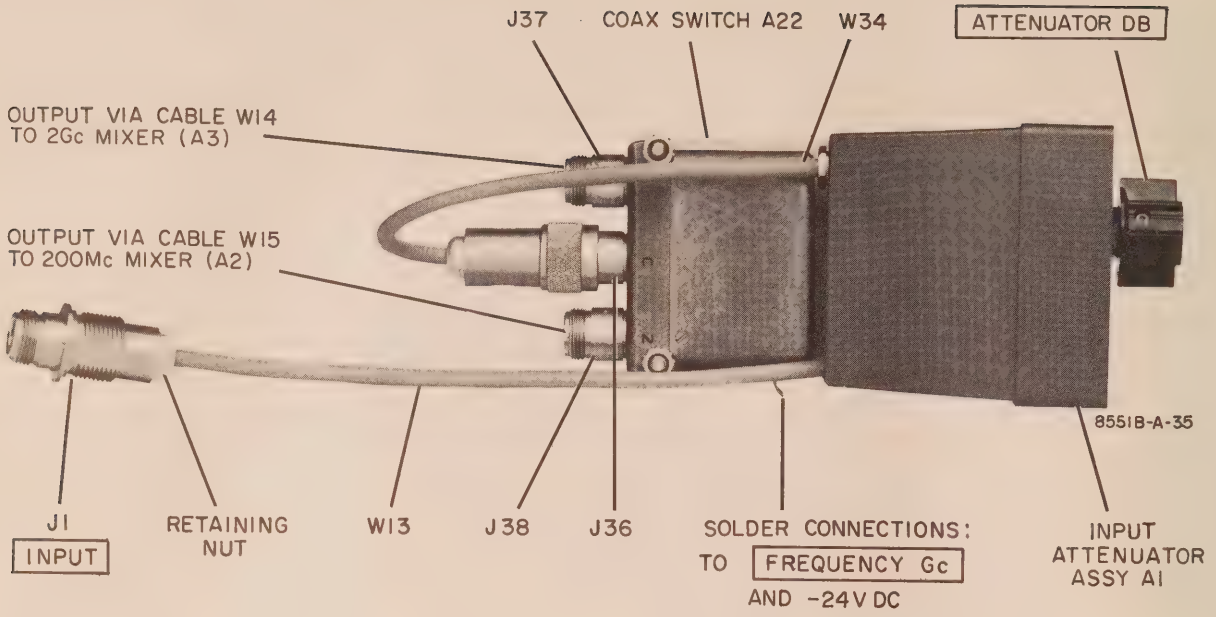


Figure 7-13. Input Attenuator Assembly A1

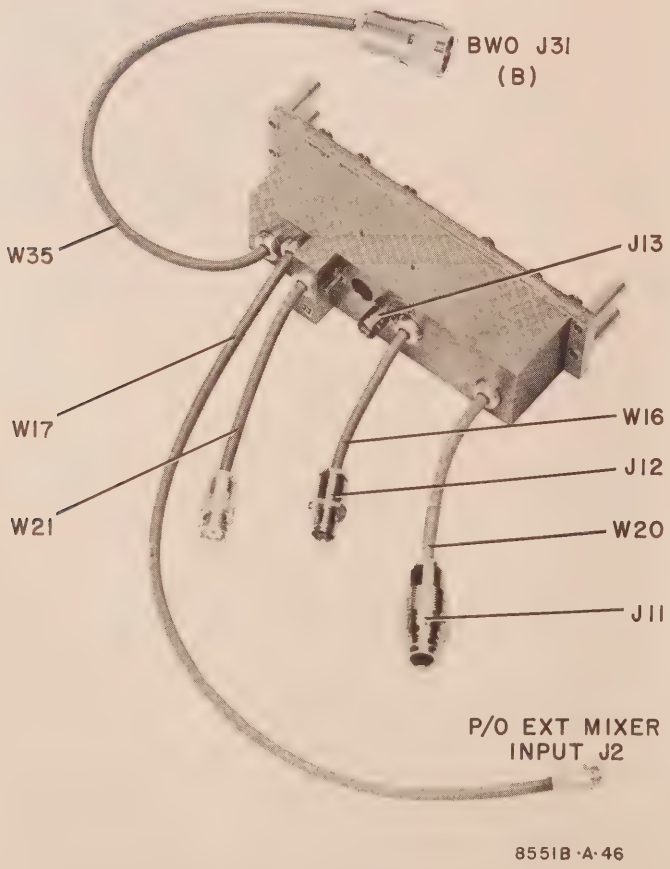
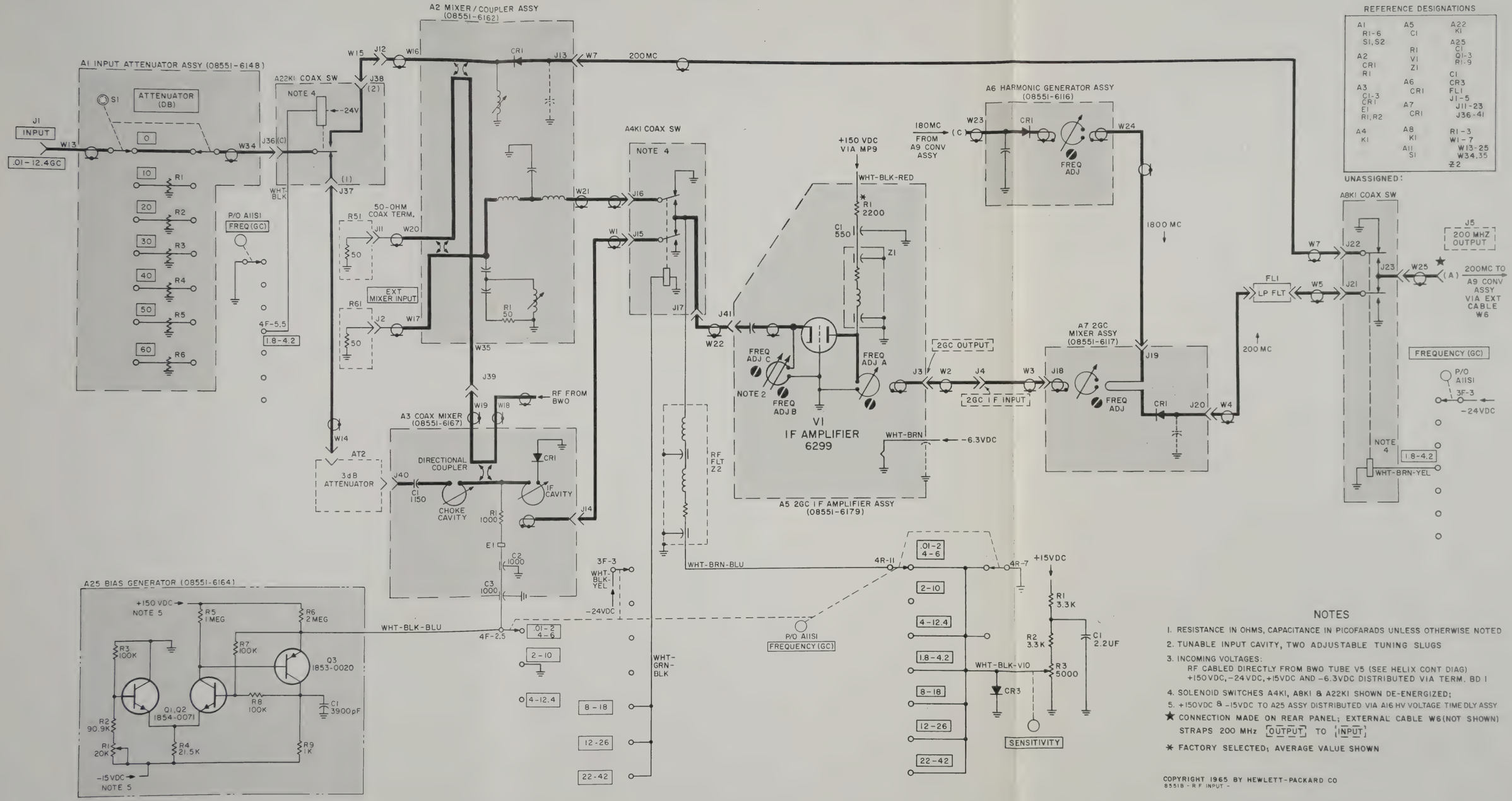


Figure 7-14. Mixer/Coupler Assembly A2



NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS UNLESS OTHERWISE NOTED
2. TUNABLE INPUT CAVITY, TWO ADJUSTABLE TUNING SLUGS
3. INCOMING VOLTAGES:
   RF CABLED DIRECTLY FROM BWO TUBE V5 (SEE HELIX CONT DIAG)
   +150VDC, -24VDC, +15VDC AND -6.3VDC DISTRIBUTED VIA TERM. BD I
4. SOLENOID SWITCHES A4K1, A8K1 & A22K1 SHOWN DE-ENERGIZED;
5. +150VDC & -15VDC TO A25 ASSY DISTRIBUTED VIA A16 HV VOLTAGE TIME DLY ASSY

★ CONNECTION MADE ON REAR PANEL; EXTERNAL CABLE W6(NOT SHOWN) STRAPS 200 MHz [OUTPUT] TO [INPUT]

* FACTORY SELECTED; AVERAGE VALUE SHOWN

Figure 7-15. RF Input Schematic, 8551B

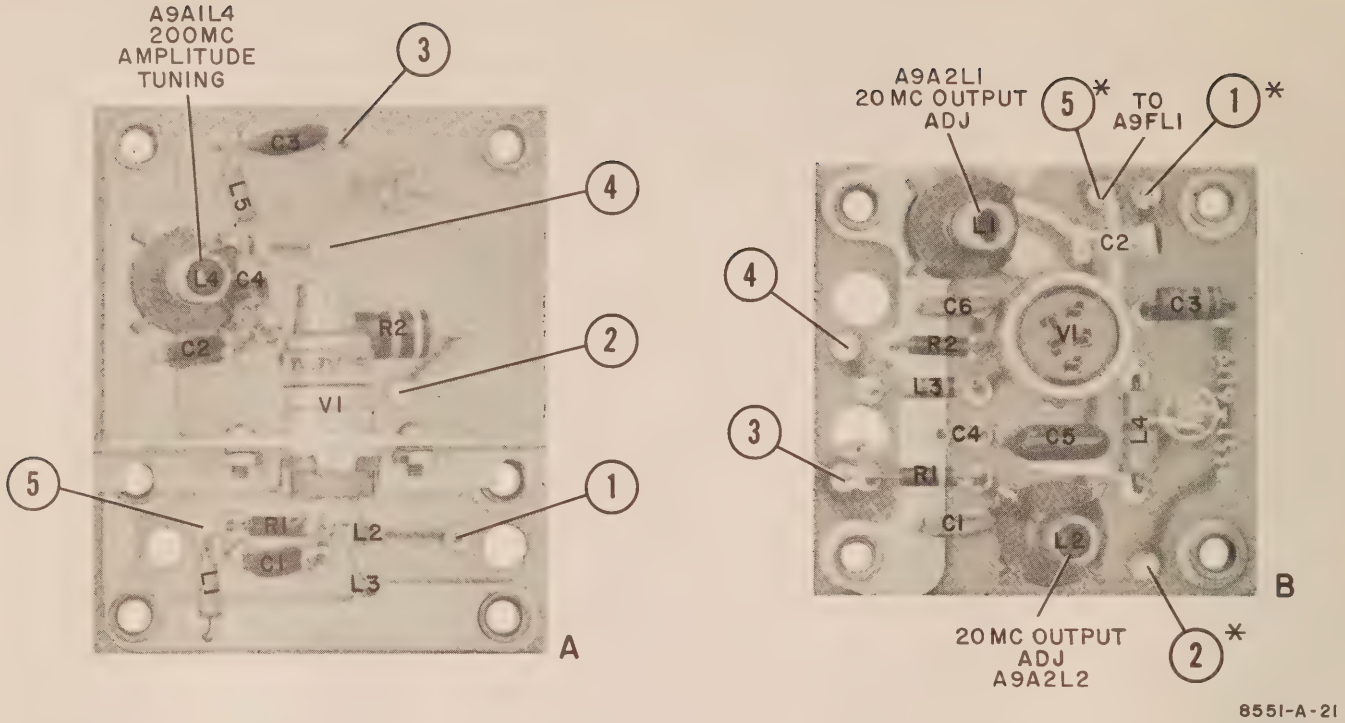


Figure 7-16. Circuit Boards for 200-Mc IF Amplifier A9A1 and 200- to 20-Mc Mixer A9A2, Model 8551

Table 7-6. Connections, 200-Mc IF Amplifier Board A1, Converter Assembly A9

Term. No.	Color Code	Connection
1	solder connection	Lead to A9C11*
2	solder connection	Lead to A9C2*
3	grn	Lead to A9L5*
4	solder connection	Lead to A9A1V1 plate
5	solder connection	Lead from J24 (200-MC input)
*See Figure 7-20		

Table 7-7. Connections, 200- to 20-Mc Mixer Board A2, Converter Assembly A9

Term. No.	Color Code	Connection
1	grn	From Inductor A9L7*
2	grn	From Buffer Amplifier V1 in Buffer Assembly A9A4
3	solder connection	Lead from A9C5*
4	solder connection	Lead from A9C14*
5	solder connection	Lead to filter A9FL1
*See Figure 7-20		

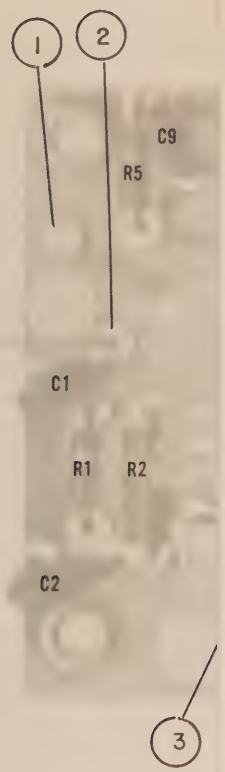


Figure '

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T

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Figure 7-18
CONVERTER SCHEMATIC, 8551B

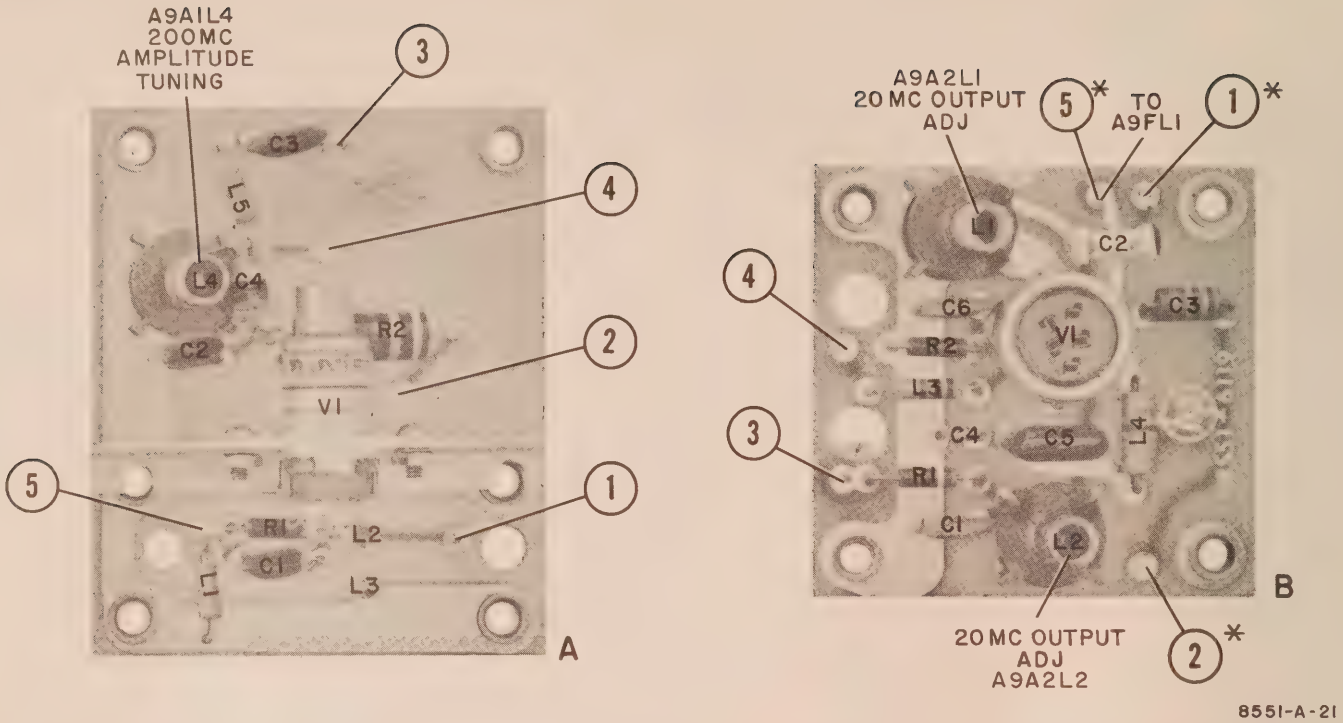


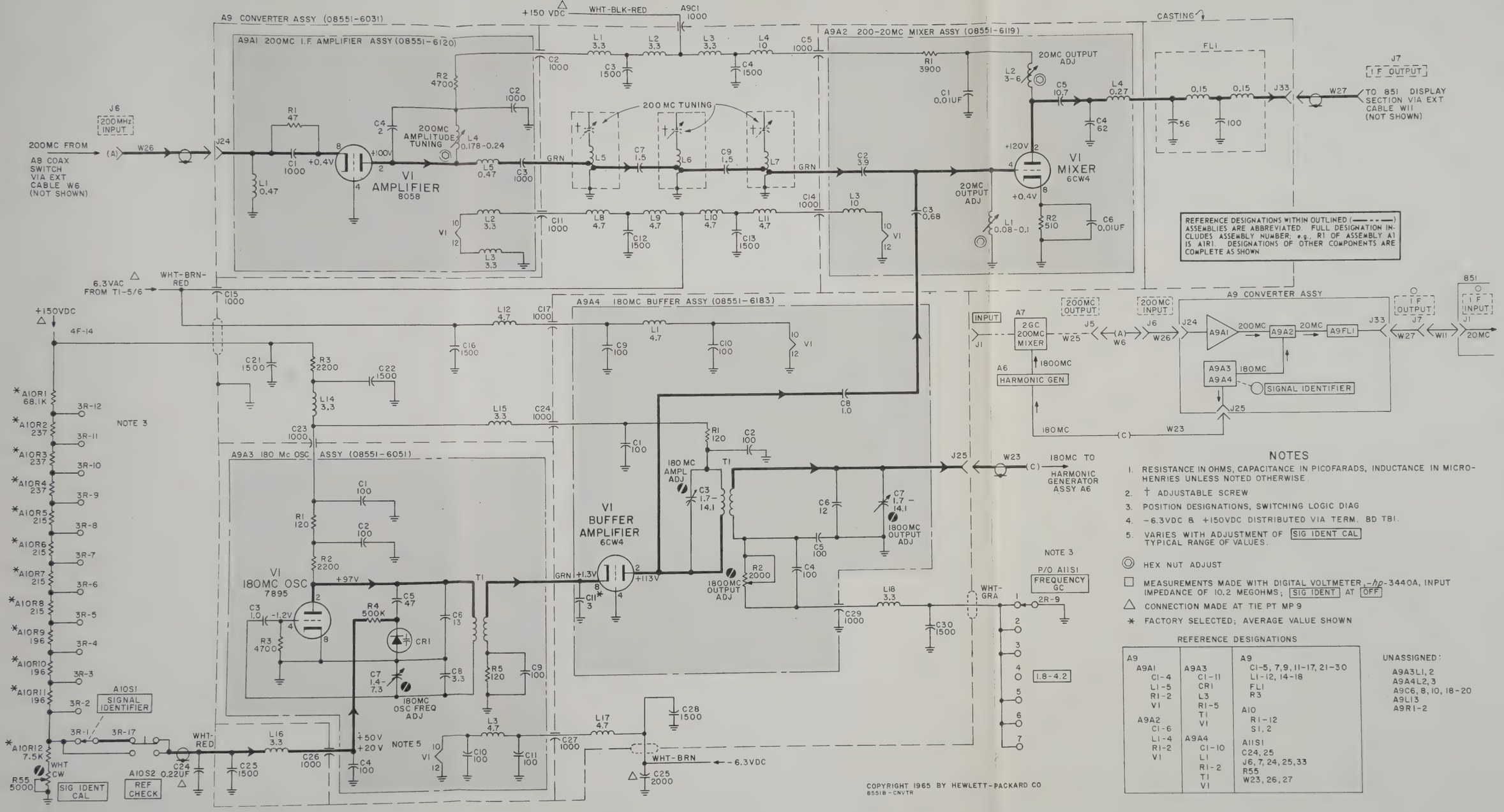
Figure 7-16. Circuit Boards for 200-Mc IF Amplifier A9A1 and 200- to 20-Mc Mixer A9A2, Model 8551

Table 7-6. Connections, 200-Mc IF Amplifier Board A1, Converter Assembly A9

Term. No.	Color Code	Connection
1	solder connection	Lead to A9C11*
2	solder connection	Lead to A9C2*
3	grn	Lead to A9L5*
4	solder connection	Lead to A9A1V1 plate
5	solder connection	Lead from J24 (200-MC input)
*See Figure 7-20		

Table 7-7. Connections, 200- to 20-Mc Mixer Board A2, Converter Assembly A9

Term. No.	Color Code	Connection
1	grn	From Inductor A9L7*
2	grn	From Buffer Amplifier V1 in Buffer Assembly A9A4
3	solder connection	Lead from A9C5*
4	solder connection	Lead from A9C14*
5	solder connection	Lead to filter A9FL1
*See Figure 7-20		



NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS, INDUCTANCE IN MICROHENRIES UNLESS NOTED OTHERWISE.
2. † ADJUSTABLE SCREW
3. POSITION DESIGNATIONS, SWITCHING LOGIC DIAG
4. -6.3VDC & +150VDC DISTRIBUTED VIA TERM. BD TB1.
5. VARIES WITH ADJUSTMENT OF [SIG IDENT CAL]. TYPICAL RANGE OF VALUES.

◎ HEX NUT ADJUST

□ MEASUREMENTS MADE WITH DIGITAL VOLTMETER, *hp*-3440A, INPUT IMPEDANCE OF 10.2 MEGOHMS; [SIG IDENT] AT [OFF]

△ CONNECTION MADE AT TIE PT MP 9

* FACTORY SELECTED; AVERAGE VALUE SHOWN

REFERENCE DESIGNATIONS

A9	A9A3	A9
A9A1	C1-11	C1-5, 7, 9, 11-17, 21-30
C1-4	CR1	L1-12, 14-18
L1-5	L3	FL1
R1-2	R1-5	R3
V1	T1	A10
A9A2	V1	R1-12
C1-6	A9A4	S1, 2
L1-4	C1-10	A11S1
R1-2	L1	C24, 25
V1	R1-2	J6, 7, 24, 25, 33
	T1	R55
	V1	W23, 26, 27

UNASSIGNED:
A9A3L1, 2
A9A4L2, 3
A9C6, 8, 10, 18-20
A9L13
A9R1-2

Figure 7-18. Converter Schematic, 8551B

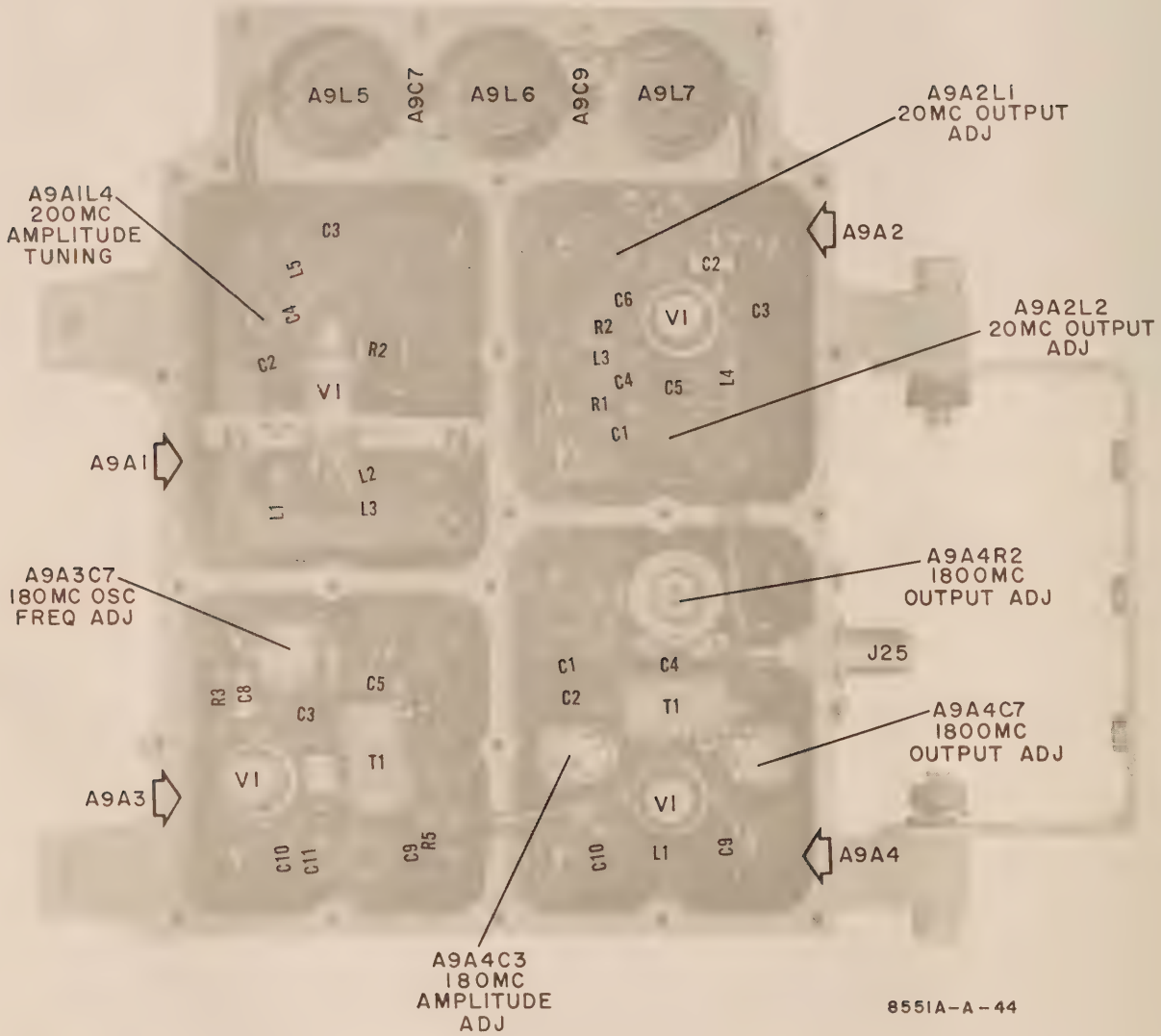


Figure 7-19. Converter Assembly A9, Top Cover Removed

TUNING SCREWS

F

Figure 7-21
SWITCHING LOGIC SCHEMATIC, 8551B

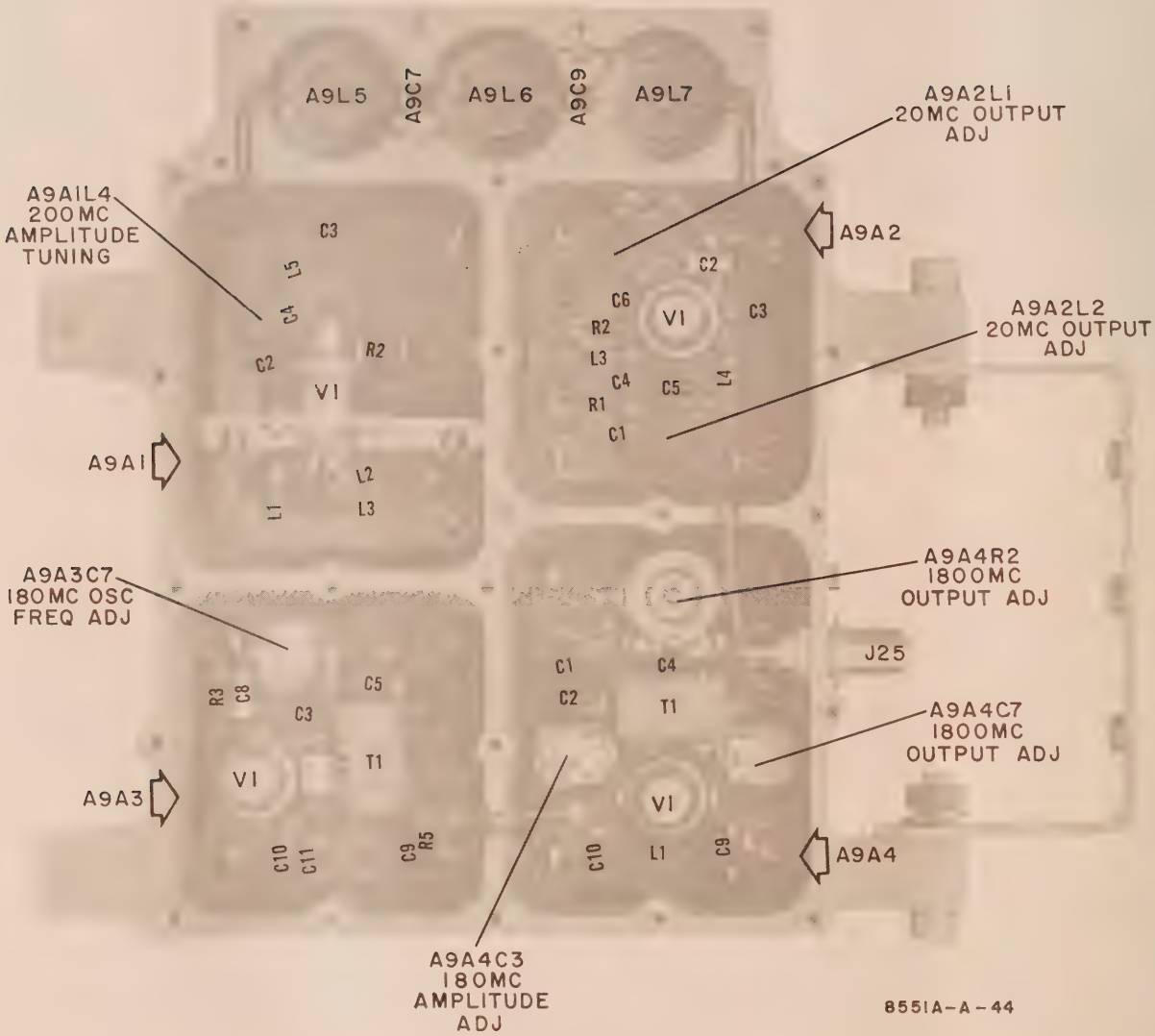
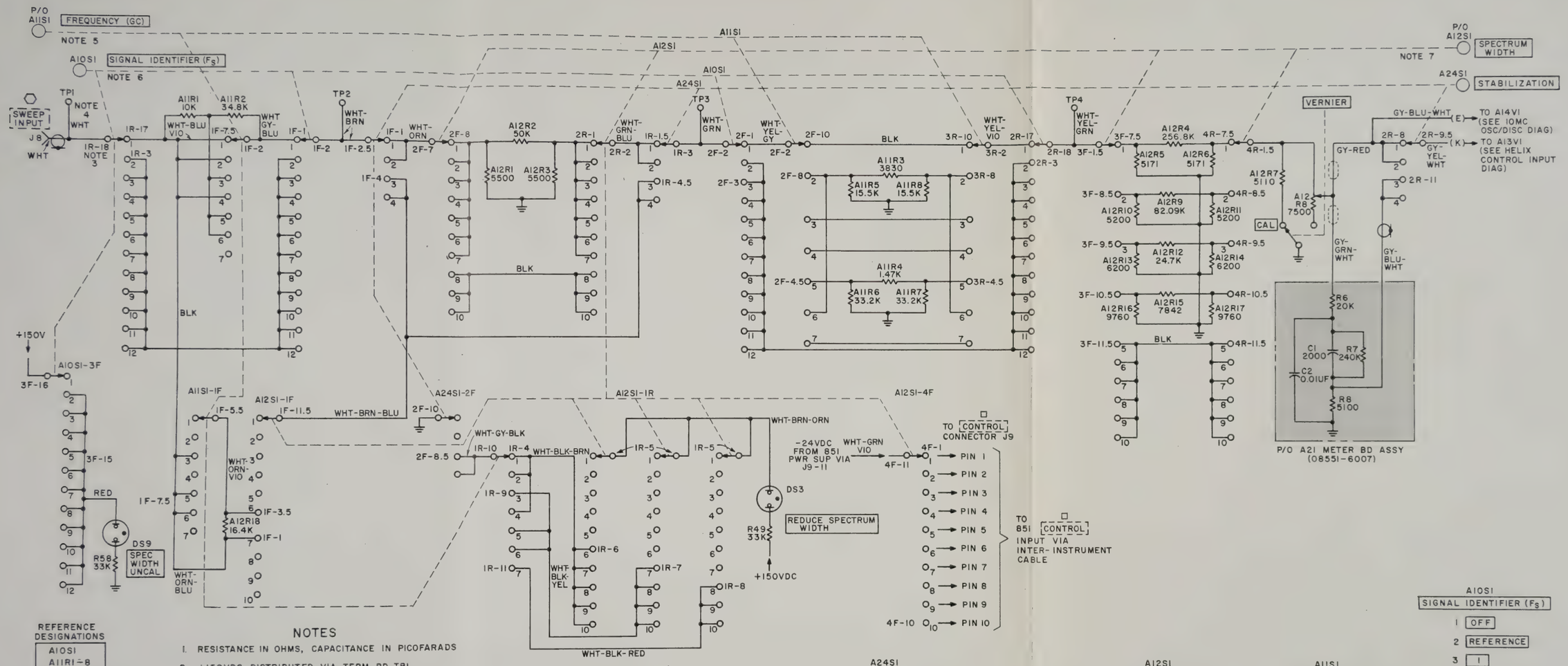


Figure 7-19. Converter Assembly A9, Top Cover Removed



REFERENCE DESIGNATIONS

A10S1
A11R1-8
A11S1
A12R1-18
A12S1
A21
A21C1, 2
A21R6-8
A24S1
DS3, 9
J8
R49, 58
TP1-4

DELETED:

NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS
2. +150VDC DISTRIBUTED VIA TERM. BD TB1
3. 1R-18 = 1ST WAFER, REAR SIDE, CONTACT 18
4. TEST POINTS TP1 THRU TP4 MOUNTED ON BRACKET ON REAR OF FRONT PANEL.
5. FOR OTHER SECTIONS OF A11S1, SEE RF INPUT AND CONVERTER DIAGRAMS
6. FOR OTHER SECTIONS OF A10S1, SEE CONVERTER DIAGRAM
7. FOR OTHER SECTIONS OF A12S1 AND A24S1, SEE HELIX CONTROL INPUT DIAGRAM

A24S1 STABILIZATION

1	UNSTABILIZED
2	PRE STAB BAL
3	STABILIZED
4	OSC TRACK

A12S1 SPECTRUM WIDTH

1	10	KC/CM
2	30	
3	100	
4	300	
5	1	MC/CM
6	3	
7	10	
8	30	
9	100	
10	200	

A11S1 FREQUENCY (GC)

1	.01 – 2 4 – 6
2	2 – 10
3	4 – 12.4
4	1.8 – 4.2
5	8 – 18
6	12 – 26
7	22 – 42

A10S1 SIGNAL IDENTIFIER (Fs)

1	OFF
2	REFERENCE
3	1
4	2
5	3
6	4
7	5
8	6
9	7
10	8
11	9
12	10

Figure 7-21. Switching Logic Schematic, 8551B

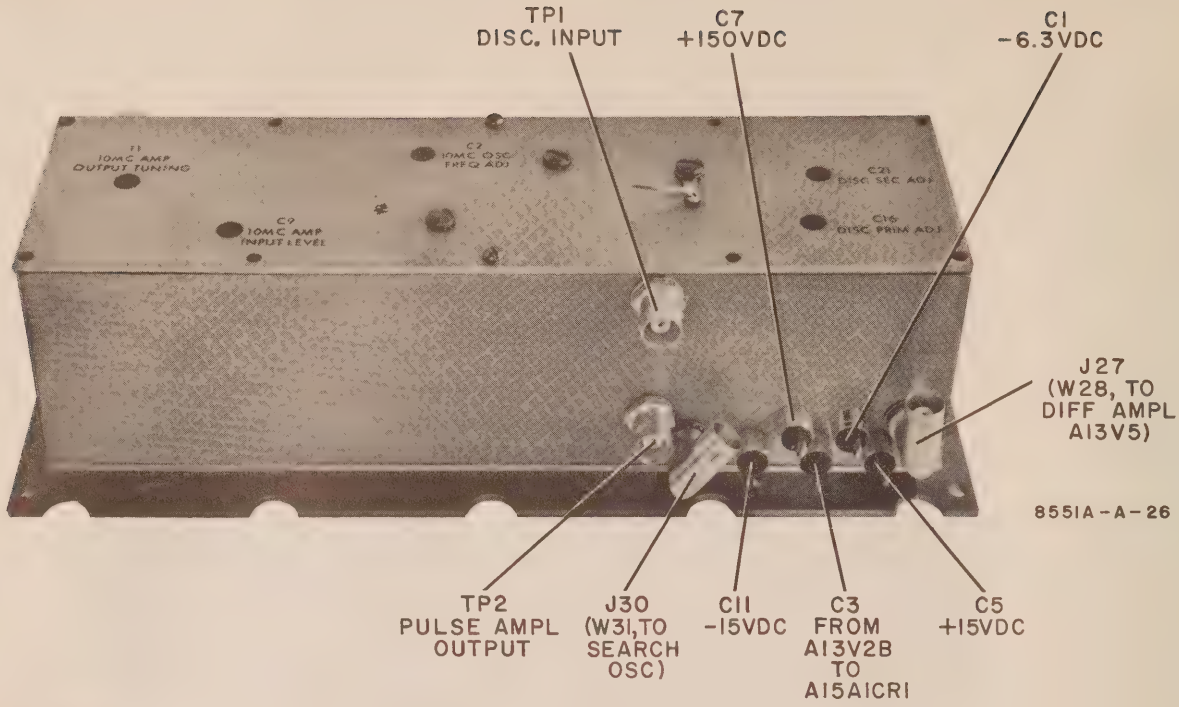


Figure 7-22. Lock Assembly A15

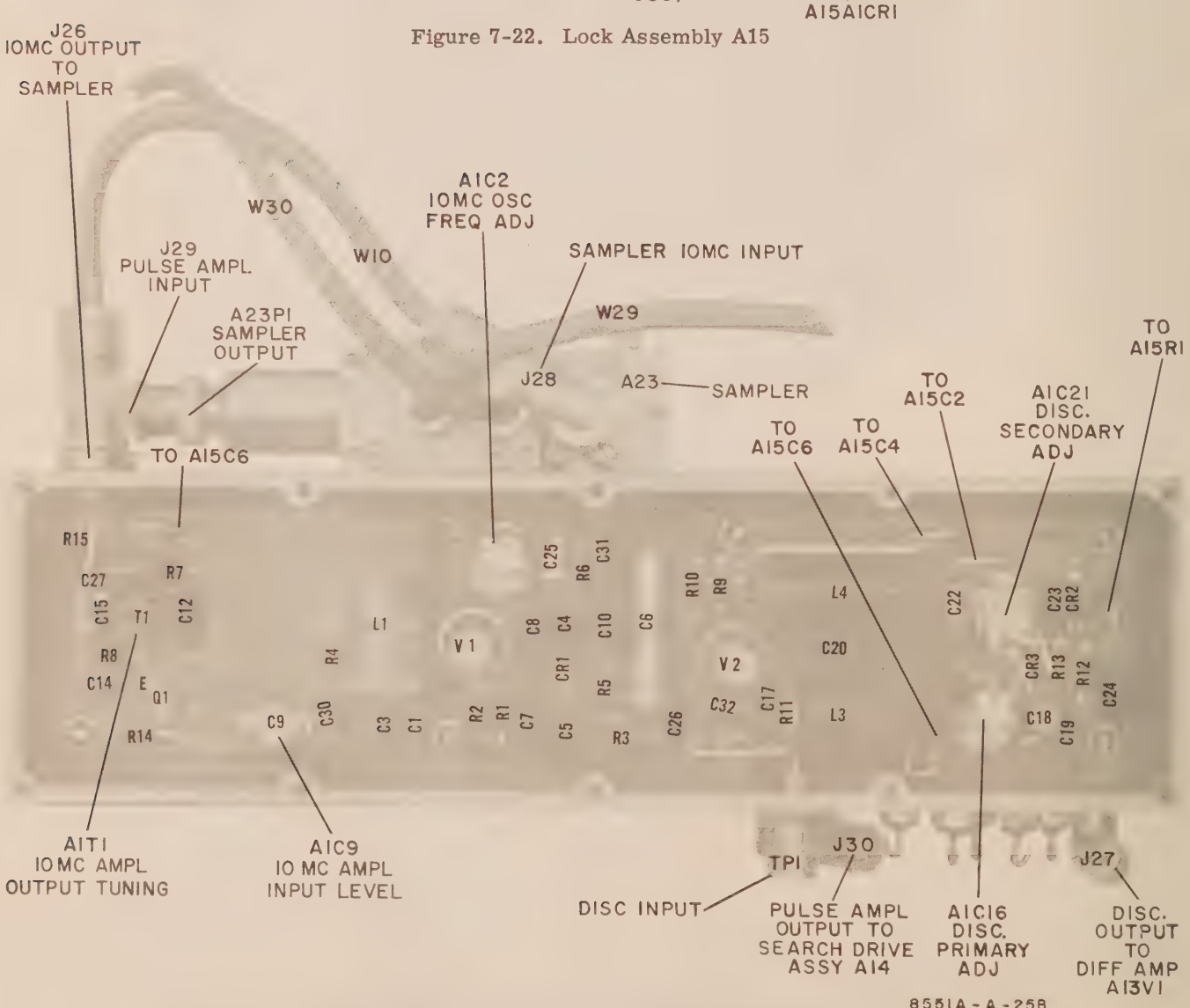


Figure 7-23. 10MC Osc/Disc. Board A15A1 (Prefix all designations with A15A1)

Figu

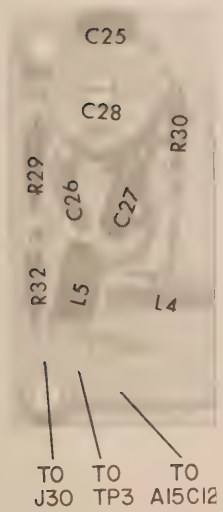


Figure 7-

Figure 7-26

10MC OSCILLATOR/DISCRIMINATOR SCHEMATIC, 8551B

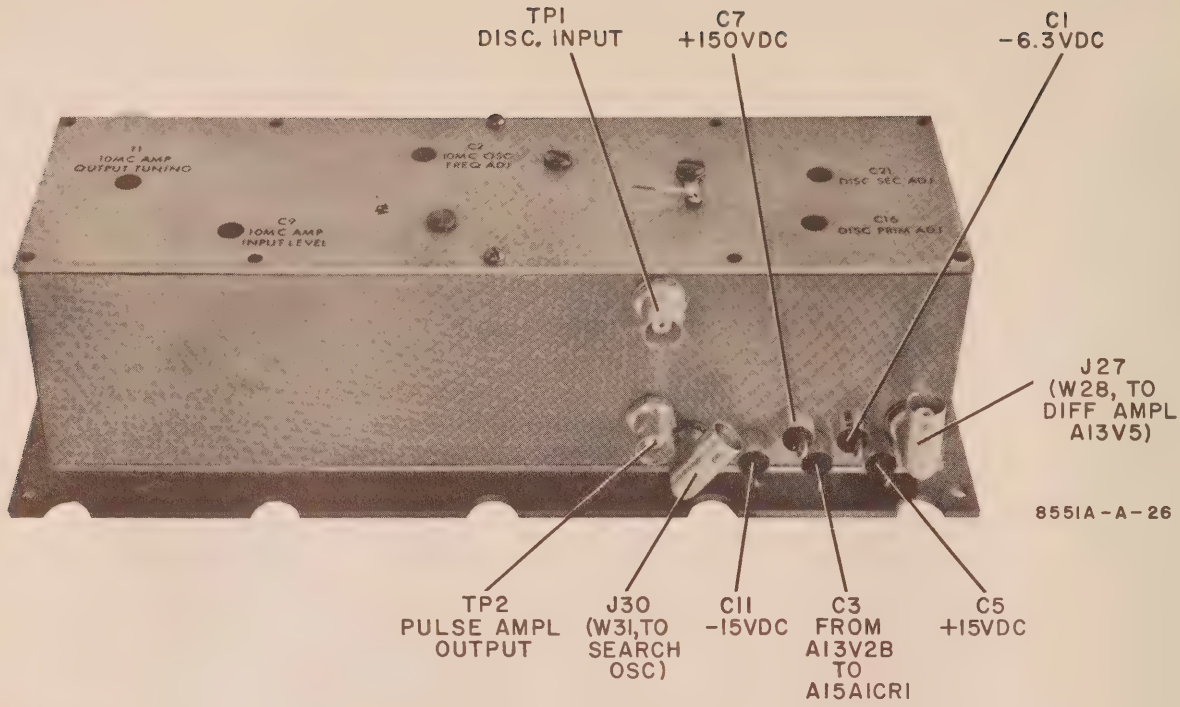


Figure 7-22. Lock Assembly A15

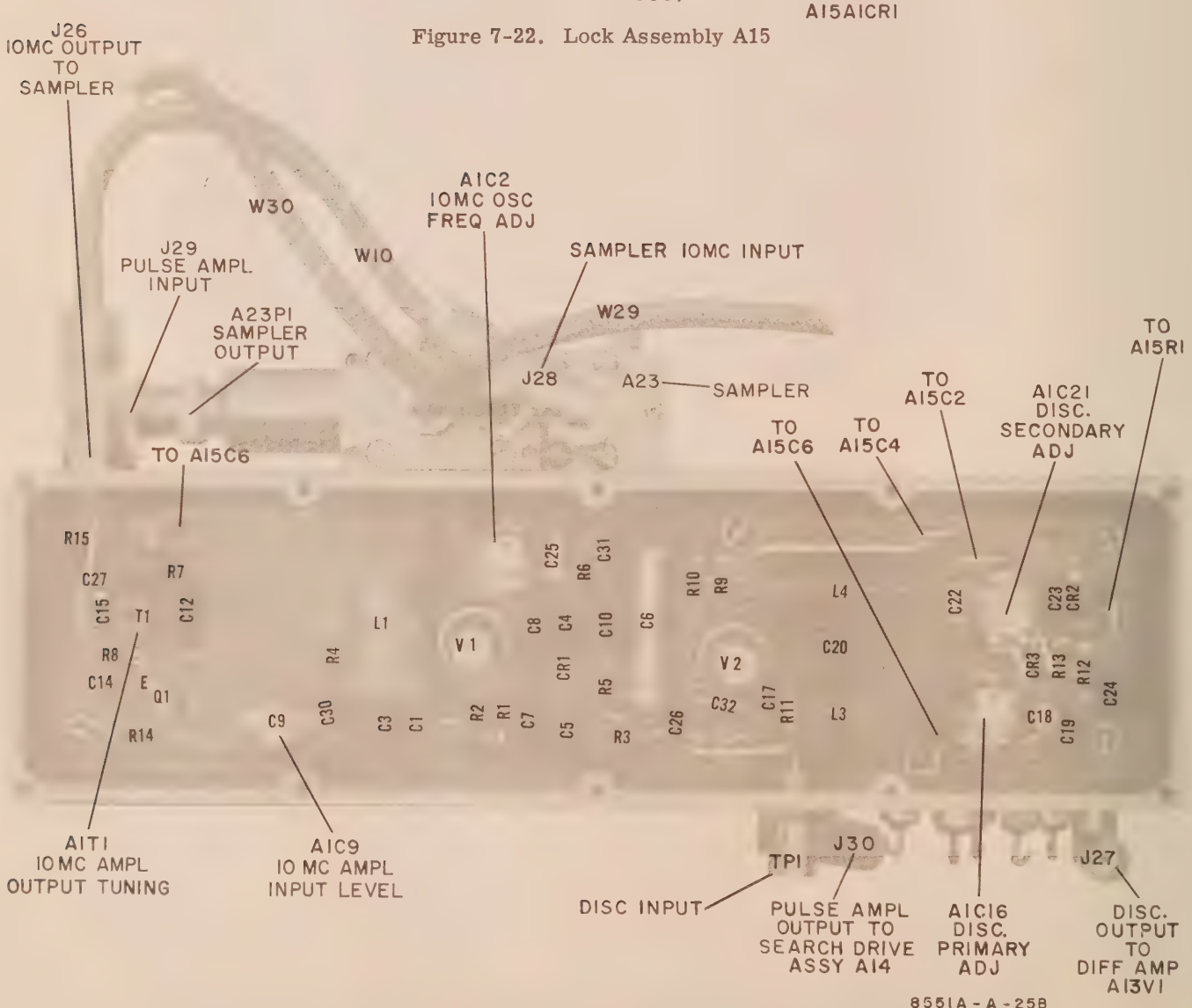


Figure 7-23. 10MC Osc/Disc. Board A15A1 (Prefix all designations with A15A1)

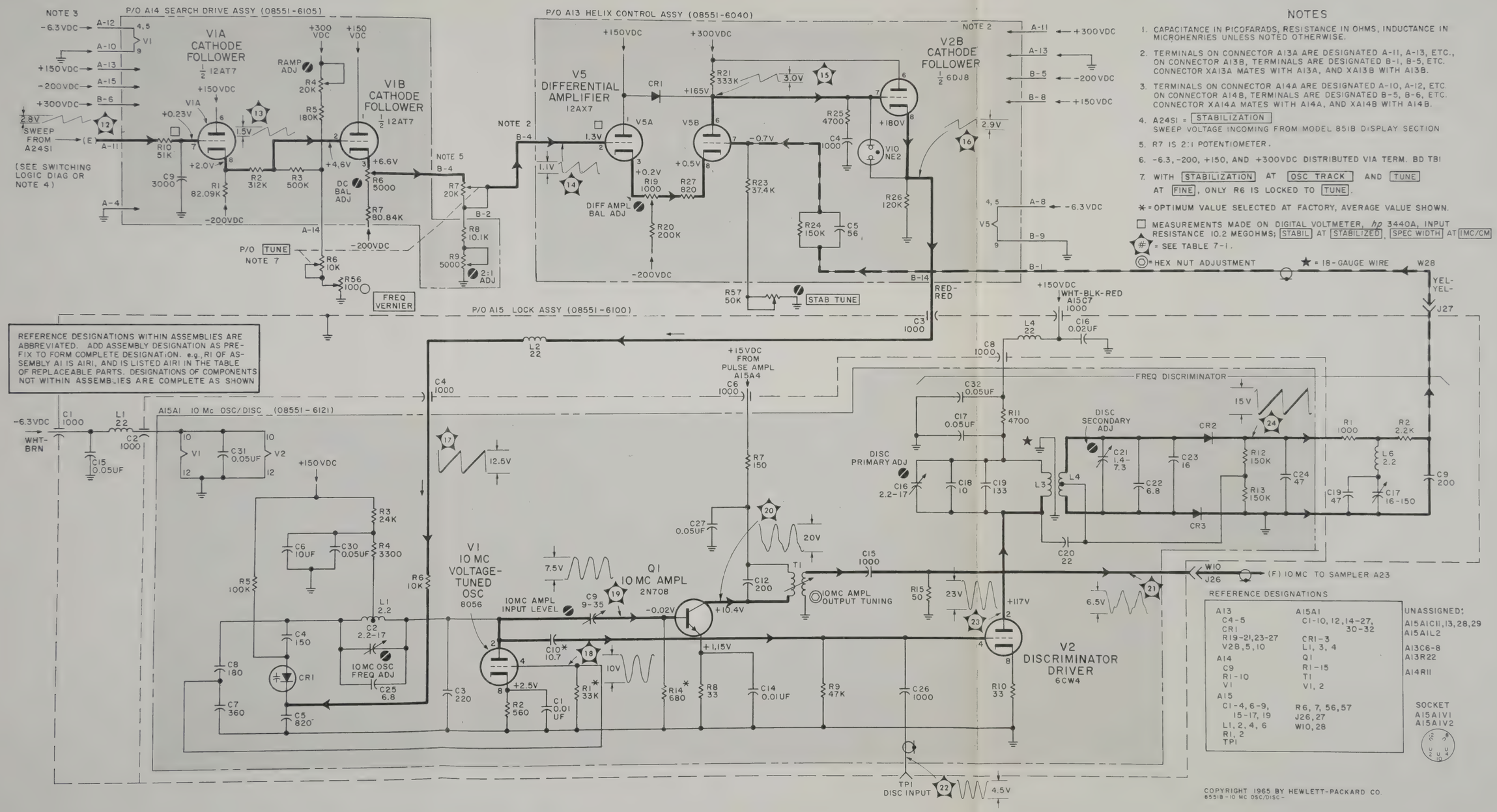


Figure 7-26. 10MC Oscillator/Discriminator Schematic, 8551B

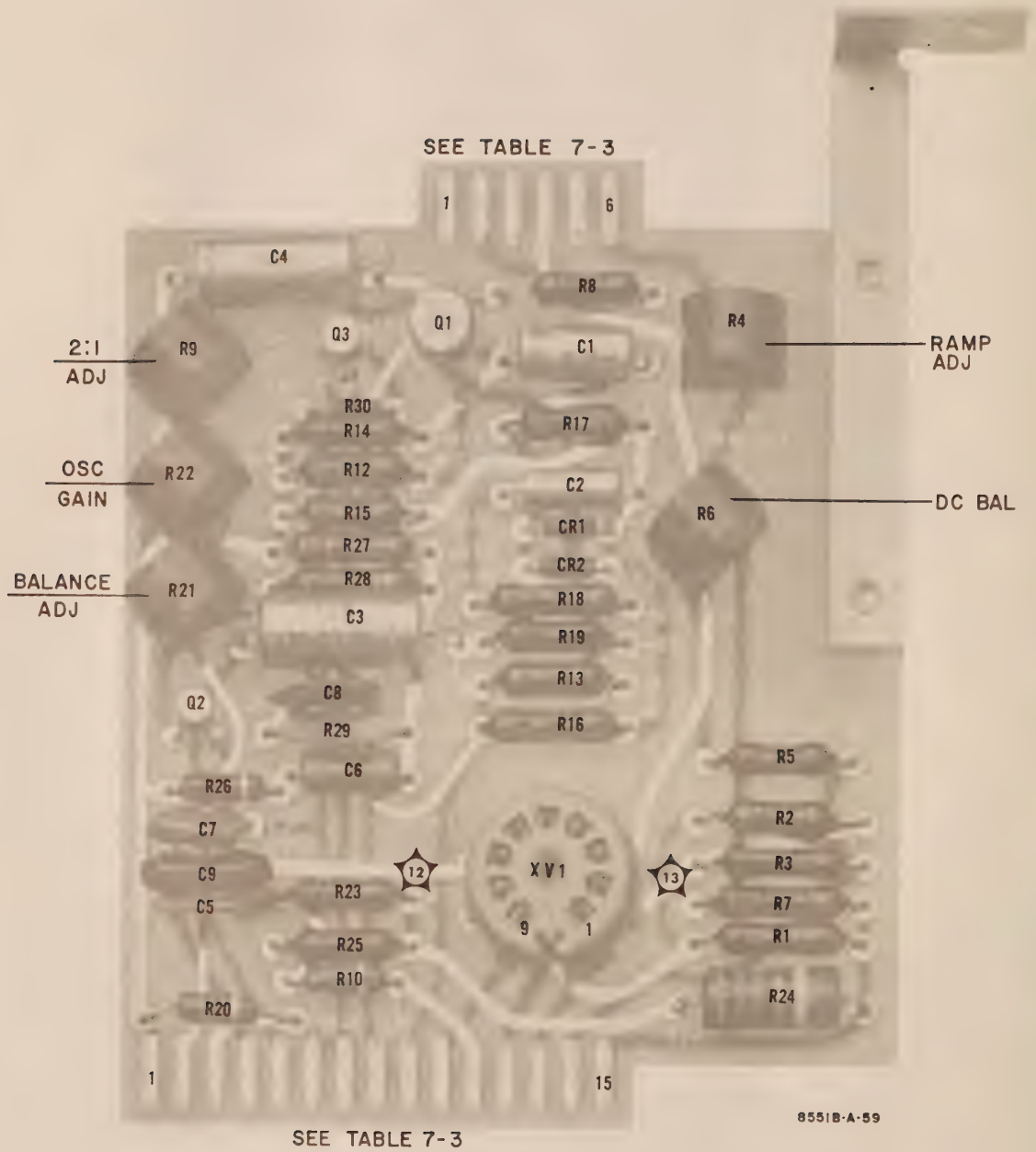


Figure 7-27. Circuit Board for Sampler/Search Drive Assembly A14

1. Resistance
2. Connector
3. +15 V dc,
4. Unlocked
5. TUNE sho
switch net

6. Measurem
STABILIZ

Figure 7-29
SAMPLER/SEARCH DRIVE SCHEMATICS, 8551B

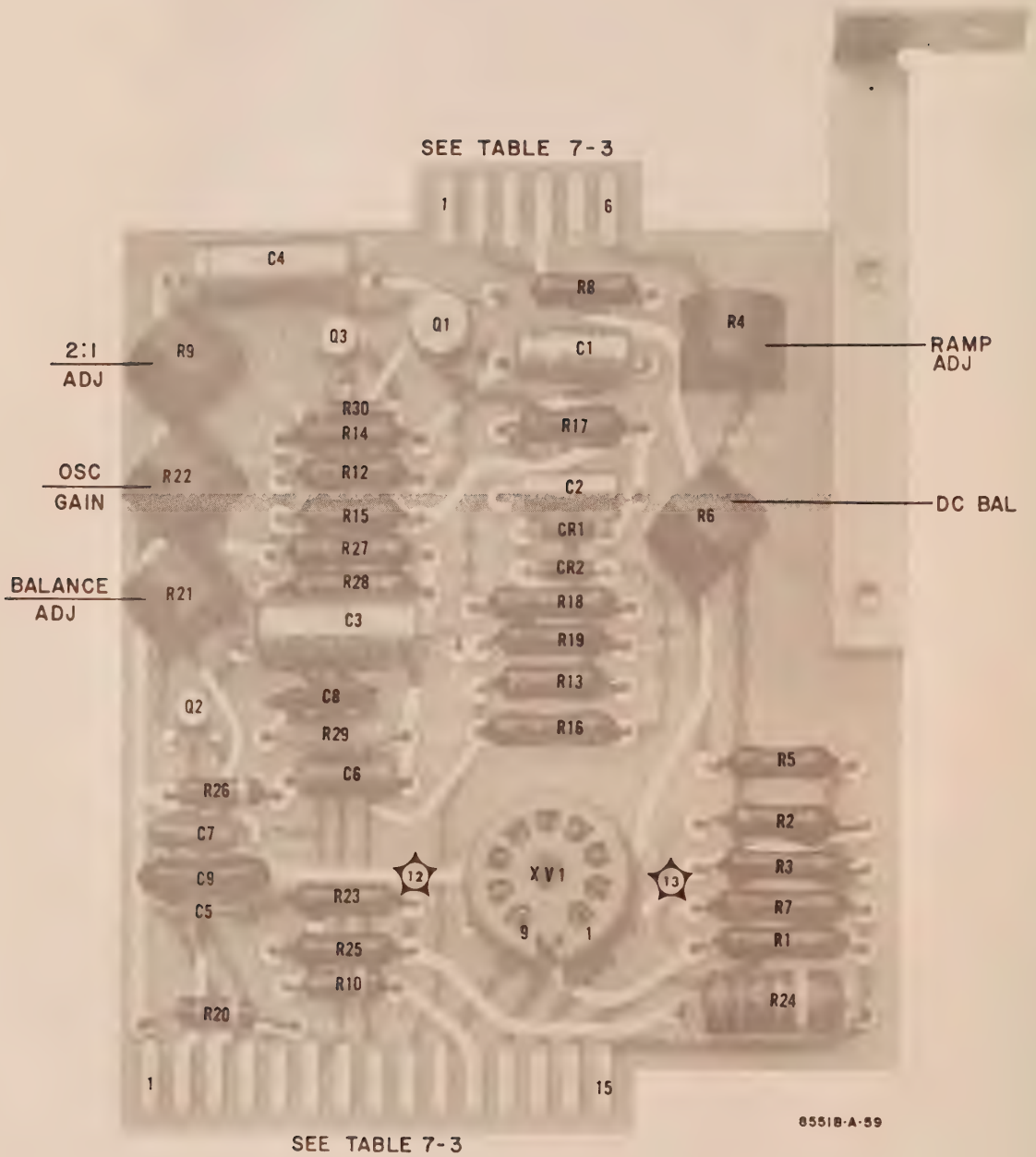


Figure 7-27. Circuit Board for Sampler/Search Drive Assembly A14

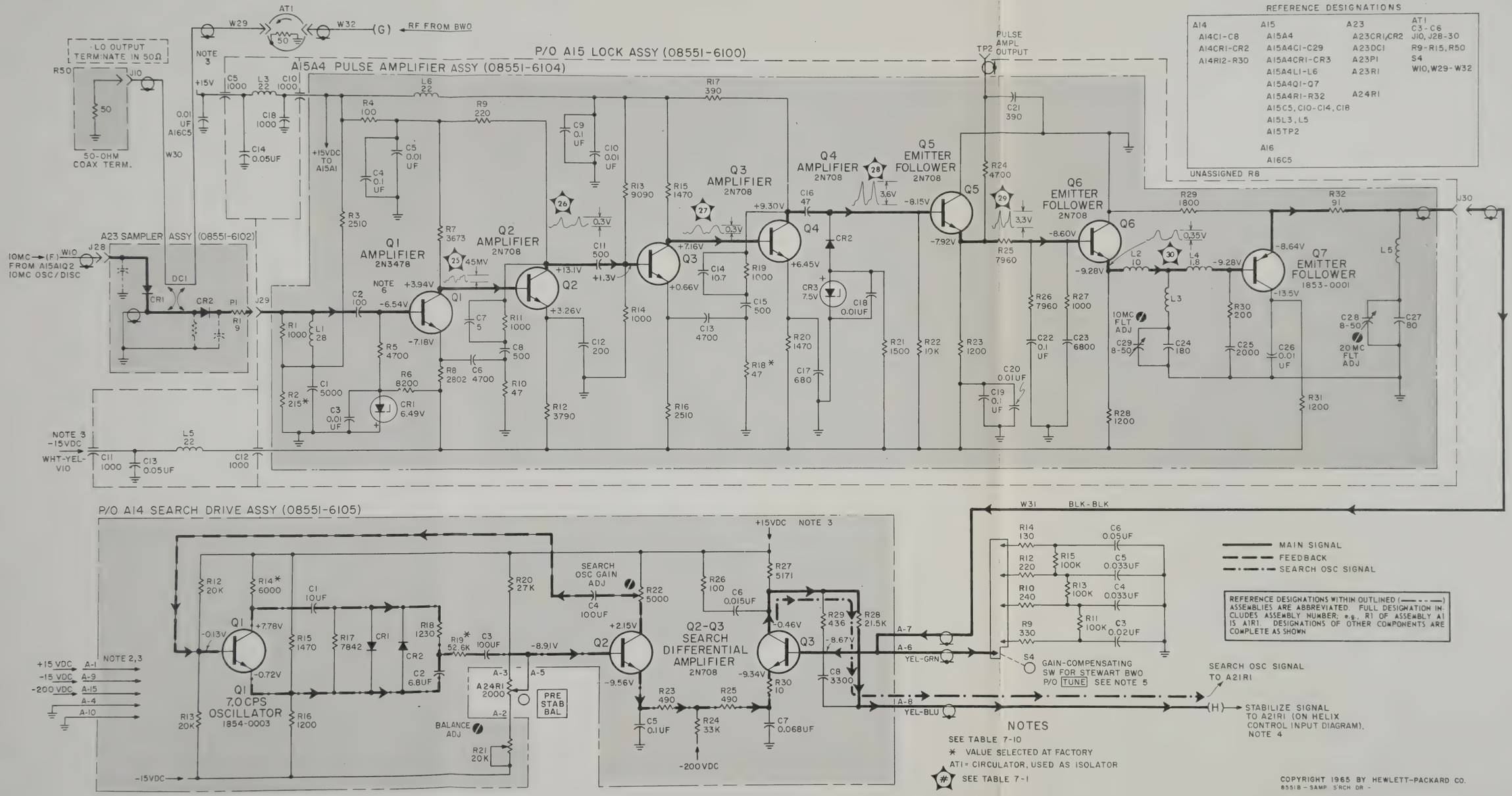


Figure 7-29. Sampler/Search Drive Schematics, 8551B

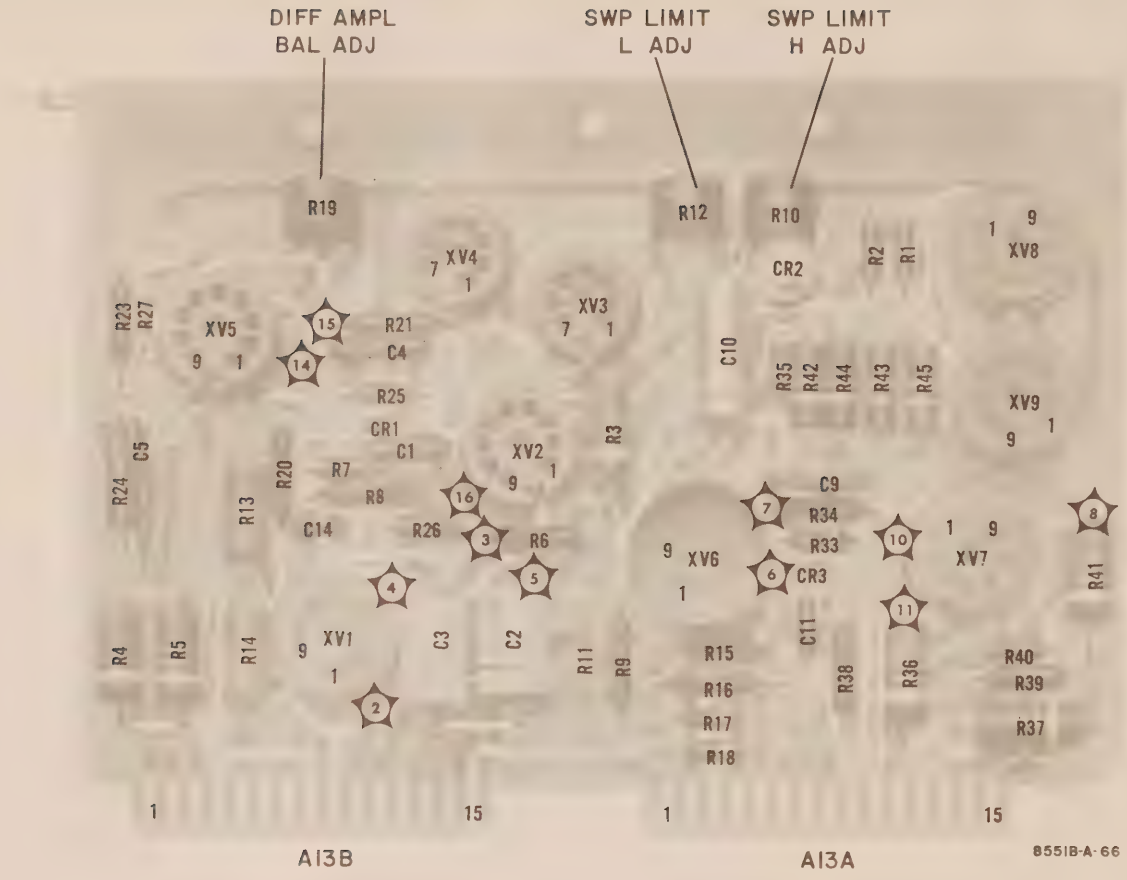


Figure 7-30. Component Side, Circuit Board for Helix Control Assembly A13

Table 7-11. Connections, A13 Helix Control Assembly Board

Conn	Pin No.	Mates With	Color Code	Connection
A13A	1	XA13A	blk	From R5, P/O TUNE, Terminal CW
	2		red, connex (M)‡ } blu**	From R5, Terminal S (swinger)
	3		wht	From R5, Terminal CCW
	4		blk	From 3R-6 (3-MC/CM position) SPECTRUM WIDTH switch A12S1
	5		grn } wht**	From 3R-8 (30 MC/CM), A12S1
	6		red	From 3R-10 (200 MC/CM), A12S1
	7		wht	From 3R-9 (100 MC/CM), A12S1
	8		wht-brn, 2 leads	-6.3 V dc, from LV Rect A18 via TB1
	9		wht-blk-red, 3 leads	+150 V dc from LV Pwr Sup A19 via TB1
	10		wht-wht (coax)	To junc. A17R25/R28, Helix Voltage Shaper A17
	11		wht-red	+300 V dc from LV Pwr Sup A19, via TB1
	12		wht-vio	-200 V dc from LV Pwr Sup A19 via TB1
	13		blk	To chassis ground*
	14		wht-blk-brn, 2 leads	6.3 V ac from T1-5
	15		wht-brn-red, 2 leads	6.3 V ac from T1-6

* To tie point near capacitor C16. ** Cable color code. ‡(M) = designation used on schematic for this connection

Conn	Pin No.
A13B	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
	12
	13
	14
	15

Terminal
1
2

* To tie point nea

02435-1

Figure 7-32

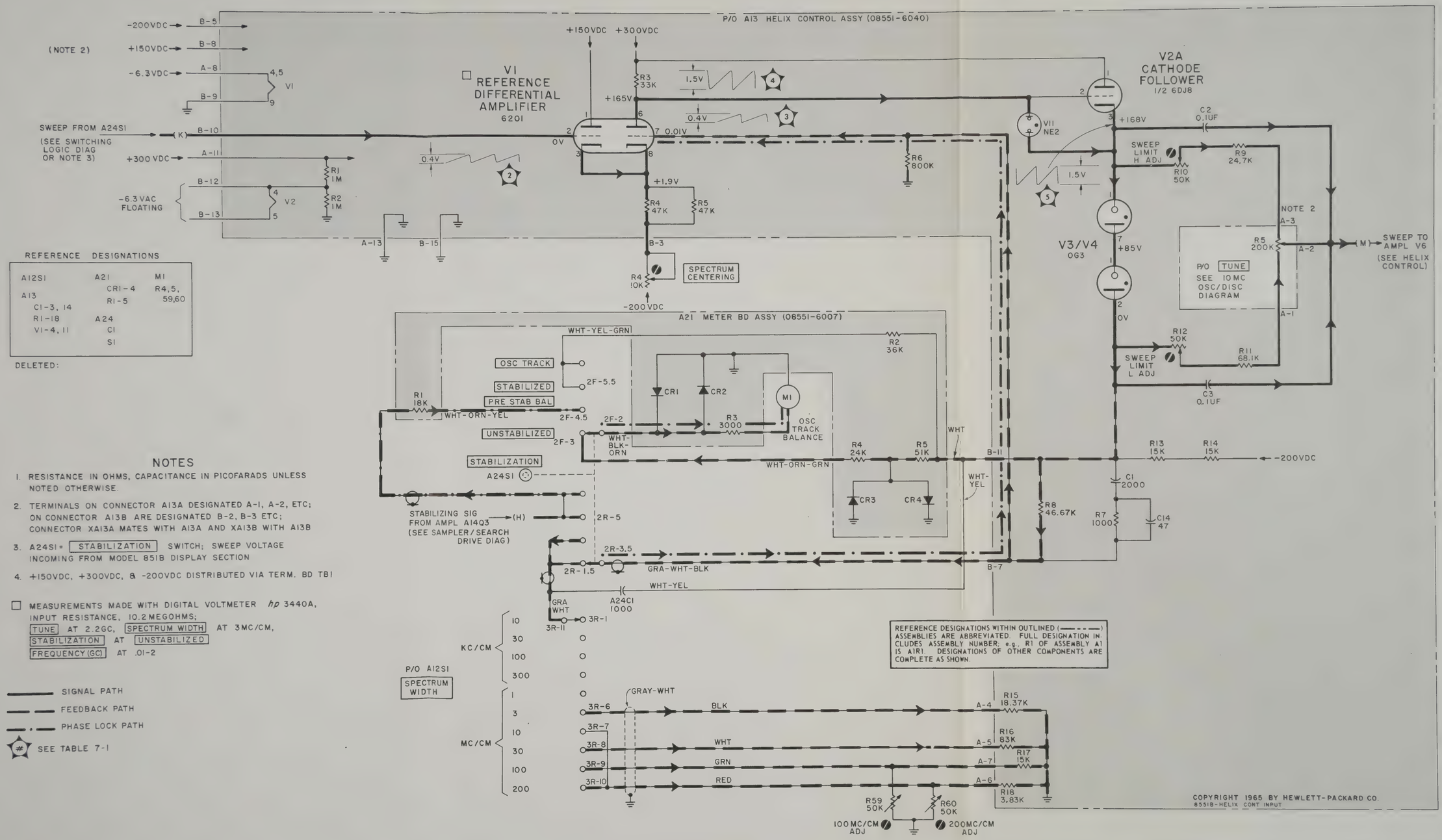
HELIX CONTROL INPUT SCHEMATIC, 8551B

Figure 7-30. Component Side, Circuit Board for Helix Control Assembly A13

Table 7-11. Connections, A13 Helix Control Assembly Board

Conn	Pin No.	Mates With	Color Code	Connection
A13A	1	XA13A	blk	From R5, P/O TUNE, Terminal CW
	2		red, connex (M)‡ } blu**	From R5, Terminal S (swinger)
	3		wht	From R5, Terminal CCW
	4		blk	From 3R-6 (3-MC/CM position) SPECTRUM WIDTH switch A12S1
	5		grn } wht**	From 3R-8 (30 MC/CM), A12S1
	6		red	From 3R-10 (200 MC/CM), A12S1
	7		wht	From 3R-9 (100 MC/CM), A12S1
	8		wht-brn, 2 leads	-6.3 V dc, from LV Rect A18 via TB1
	9		wht-blk-red, 3 leads	+150 V dc from LV Pwr Sup A19 via TB1
	10		wht-wht (coax)	To junc. A17R25/R28, Helix Voltage Shaper A17
	11		wht-red	+300 V dc from LV Pwr Sup A19, via TB1
	12		wht-vio	-200 V dc from LV Pwr Sup A19 via TB1
	13		blk	To chassis ground*
	14		wht-blk-brn, 2 leads	6.3 V ac from T1-5
	15		wht-brn-red, 2 leads	6.3 V ac from T1-6

* To tie point near capacitor C16. ** Cable color code. ‡ (M) = designation used on schematic for this connection



REFERENCE DESIGNATIONS

A12S1	A21	M1
A13	CR1-4	R4,5,
C1-3, 14	R1-5	59,60
R1-18	A24	
V1-4, 11	C1	
	S1	

DELETED:

NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS UNLESS NOTED OTHERWISE.
2. TERMINALS ON CONNECTOR A13A DESIGNATED A-1, A-2, ETC; ON CONNECTOR A13B ARE DESIGNATED B-2, B-3 ETC; CONNECTOR XA13A MATES WITH A13A AND XA13B WITH A13B
3. A24S1 = STABILIZATION SWITCH; SWEEP VOLTAGE INCOMING FROM MODEL 851B DISPLAY SECTION
4. +150VDC, +300VDC, & -200VDC DISTRIBUTED VIA TERM. BD TB1

☐ MEASUREMENTS MADE WITH DIGITAL VOLTMETER *hp* 3440A, INPUT RESISTANCE, 10.2 MEGOHMS; TUNE AT 2.2GC, SPECTRUM WIDTH AT 3MC/CM, STABILIZATION AT UNSTABILIZED FREQUENCY (GC) AT .01-2

SIGNAL PATH
FEEDBACK PATH
PHASE LOCK PATH
(#) SEE TABLE 7-1

Figure 7-32. Helix Control Input Schematic, 8551B

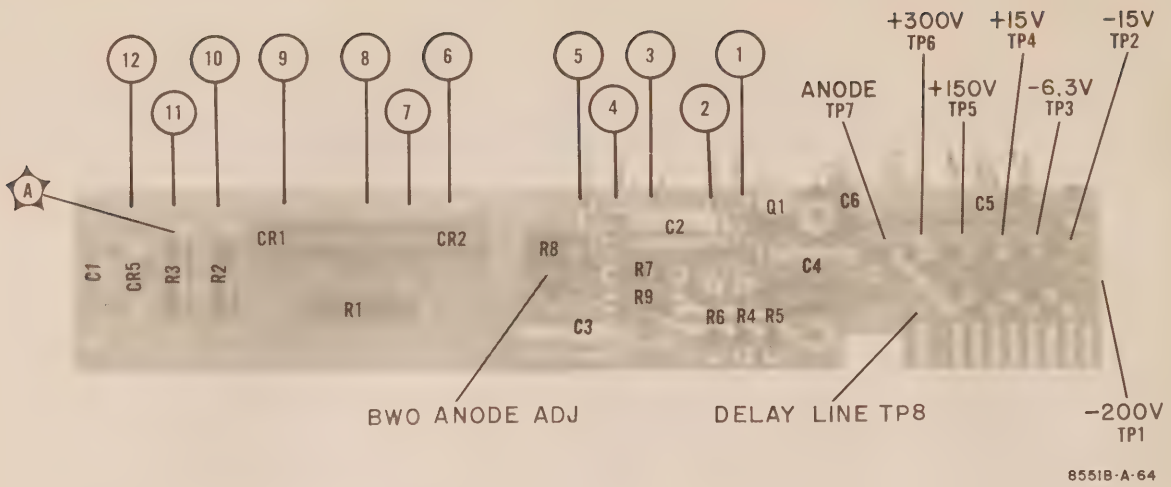


Figure 7-33. Circuit Board for HV Time Delay Assembly A16

Table 7-12. Connections, A16 HV Time Delay Assembly Board

Term. No.	Color Code	Connection
1	wht-blk-brn	To make contact on Delay Relay K1
2	wht-red	To break-make contact on Delay Relay K1
3	wht-red-orn	From break contact on Delay Relay K1
4	wht-brn	To winding of Delay Relay K1
5	wht-grn-blu	To make contact on HV Relay K2
6	gra	To chassis ground
7	red	From T3-7
8		Not occupied
9	wht	To Series Regulators V1, V2
10	orn	From T3-5
11	wht	To BWO collector
12	blu	To filter: C9, C10, R18
TP1 (-200)	wht-vio, leads	From LV Pwr Sup A19, via TB1
TP2 (-15)	wht-yel-vio, leads	From 851 via control cable and TB1
TP3 (-6.3)	wht-brn, leads	From LV Rectifier Assy A18 via TB1
TP4 (+15)	wht-red-yel, leads	From 851 via control cable and TB1
TP5 (+150)	wht-blk-red	From LV Pwr Sup A19, via TB1
TP6 (+300)	wht-red, two conductors	From LV Pwr Sup A19, via TB1
TP7 ANODE	blu, two conductors	From cathode circuit of V6
TP8 DELAY LINE (helix)	yel	From HV Overload Relay K4, via TB2

2.4 GC ADJ.

2.6 GC ADJ.

3.2 GC ADJ.

3.6 GC ADJ.

3.4 GC ADJ.

Figure 7

Figure 7-35
HELIX CONTROL SCHEMATIC, 8551B

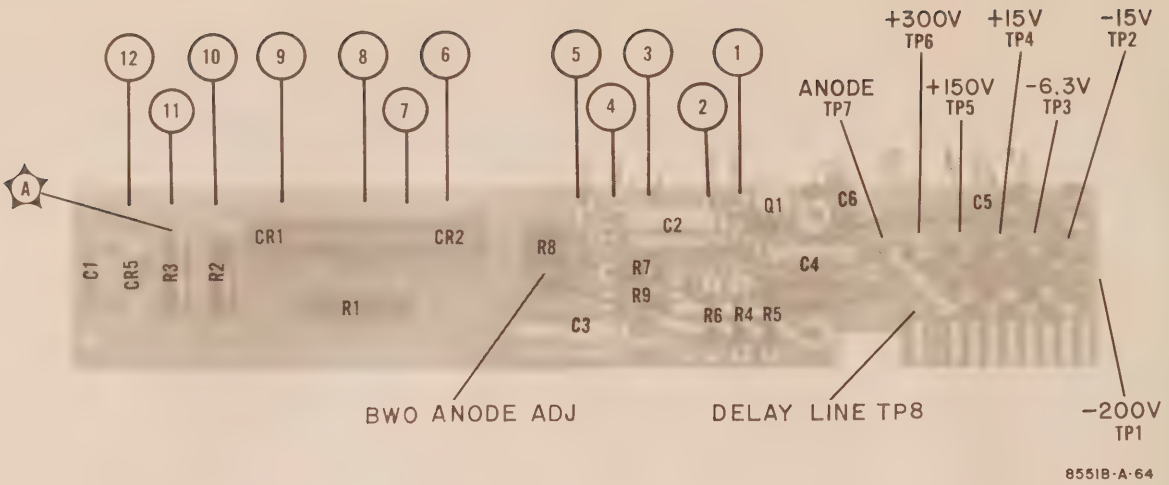
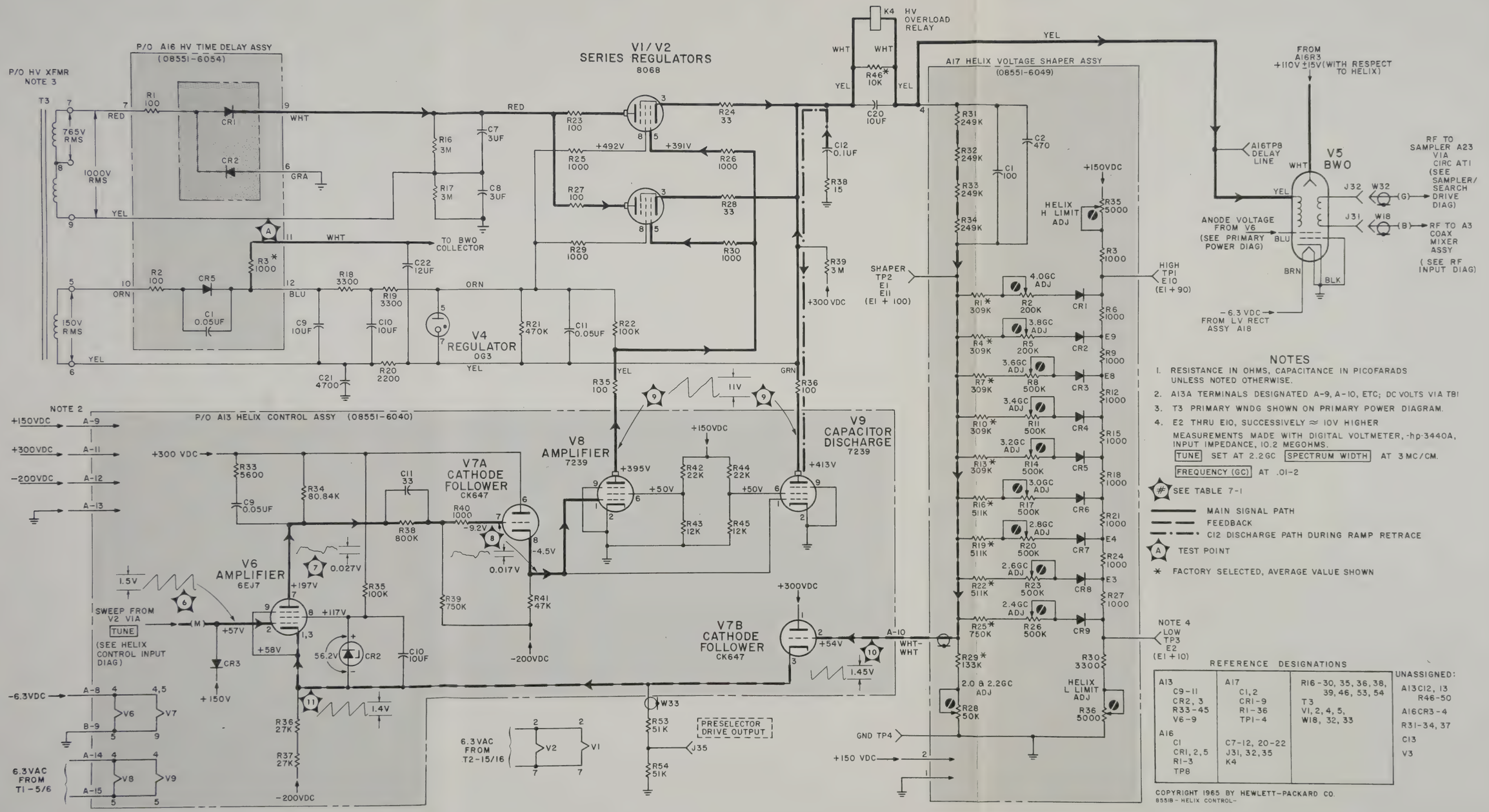


Figure 7-33. Circuit Board for HV Time Delay Assembly A16

Table 7-12. Connections, A16 HV Time Delay Assembly Board

Term. No.	Color Code	Connection
1	wht-blk-brn	To make contact on Delay Relay K1
2	wht-red	To break-make contact on Delay Relay K1
3	wht-red-orn	From break contact on Delay Relay K1
4	wht-brn	To winding of Delay Relay K1
5	wht-grn-blu	To make contact on HV Relay K2
6	gra	To chassis ground
7	red	From T3-7
8		Not occupied
9	wht	To Series Regulators V1, V2
10	orn	From T3-5
11	wht	To BWO collector
12	blu	To filter: C9, C10, R18
TP1 (-200)	wht-vio, leads	From LV Pwr Sup A19, via TB1
TP2 (-15)	wht-yel-vio, leads	From 851 via control cable and TB1
TP3 (-6.3)	wht-brn, leads	From LV Rectifier Assy A18 via TB1
TP4 (+15)	wht-red-yel, leads	From 851 via control cable and TB1
TP5 (+150)	wht-blk-red	From LV Pwr Sup A19, via TB1
TP6 (+300)	wht-red, two conductors	From LV Pwr Sup A19, via TB1
TP7 ANODE	blu, two conductors	From cathode circuit of V6
TP8 DELAY LINE (helix)	yel	From HV Overload Relay K4, via TB2



NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS UNLESS NOTED OTHERWISE.
2. A13A TERMINALS DESIGNATED A-9, A-10, ETC; DC VOLTS VIA TB1
3. T3 PRIMARY WNDG SHOWN ON PRIMARY POWER DIAGRAM.
4. E2 THRU E10, SUCCESSIVELY ≈ 10V HIGHER

MEASUREMENTS MADE WITH DIGITAL VOLTMETER, hp 3440A, INPUT IMPEDANCE, 10.2 MEGOHMS.

TUNE SET AT 2.2GC SPECTRUM WIDTH AT 3 MC/CM.

FREQUENCY (GC) AT .01-2

(#) SEE TABLE 7-1

MAIN SIGNAL PATH

FEEDBACK

C12 DISCHARGE PATH DURING RAMP RETRACE

(A) TEST POINT

* FACTORY SELECTED, AVERAGE VALUE SHOWN

REFERENCE DESIGNATIONS

A13 C9-11 CR2, 3 R33-45 V6-9 A16 C1 CR1, 2, 5 R1-3 TP8	A17 C1, 2 CR1-9 R1-36 TP1-4 C7-12, 20-22 J31, 32, 35 K4	R16-30, 35, 36, 38, 39, 46, 53, 54 T3 V1, 2, 4, 5, W18, 32, 33

UNASSIGNED:
A13C12, 13
R46-50
A16CR3-4
R31-34, 37
C13
V3

8551B-HELIX CONTROL-

Figure 7-35. Helix Control Schematic, 8551B

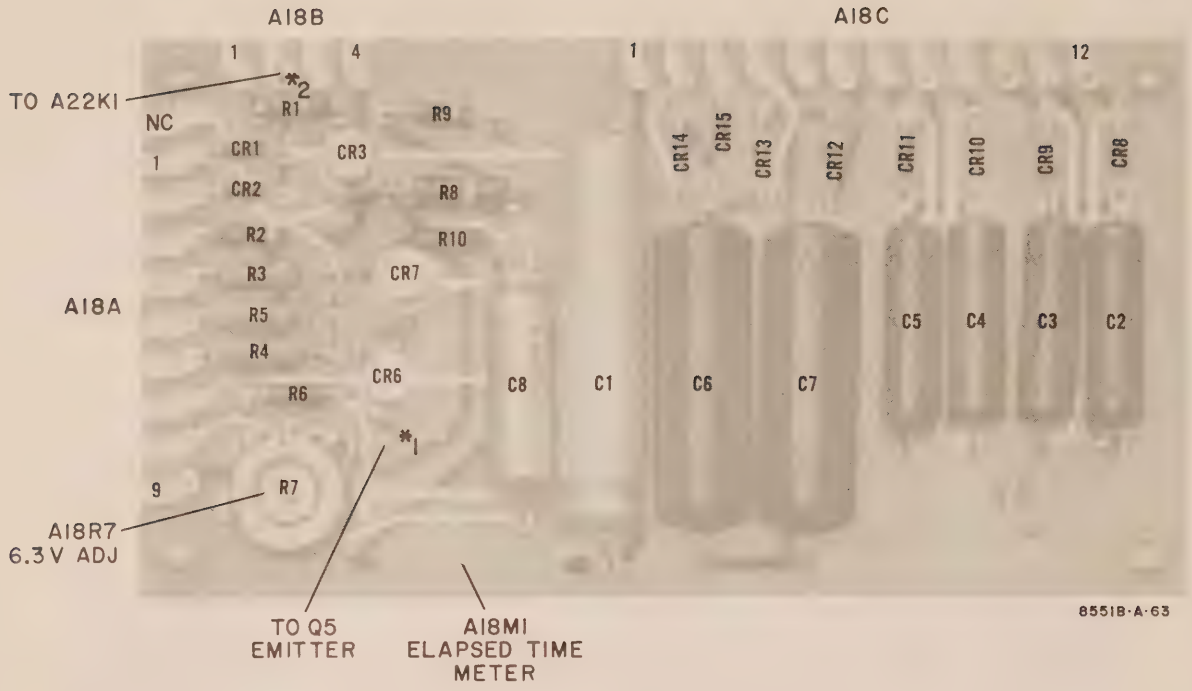
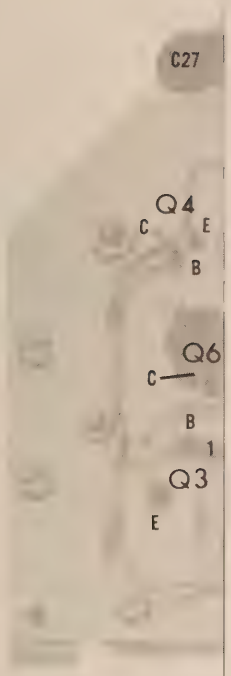


Figure 7-36. Circuit Board for LV Rectifier Assembly A18

Table 7-13. Connections, A18 LV Rectifier Assembly

Conn	Pin. No.	Mates With	Color Code	Connection
A18A	1	*	wht-blu-brn	From T1-9 and CR1
	2		wht-blu-brn	From T1-11 and CR2
	3		blk	Chassis ground, to winding of relay K3
	4		wht-yel-vio	From Q1 emitter
	5		wht-yel-blu	From Q3 emitter
	6		wht-yel-grn	From Q2 emitter
	7		wht-grn-blu	To Q1-Q2-Q3-Q4 collector
	8		wht-brn-gra	To Q4 base
	9		wht-grn-blu	To Q6 collector and base
**1			wht-red-orn	To Q5 emitter
A18B	1	*	wht-brn-gra	From relay K4 make contacts and -6.3 V dc bus
	2		wht-blk-yel	-24 V dc supply
	3		wht-blk-gra	To winding of relay K3
	4		wht-brn	-6.3 V dc supply
‡2			wht-yel-blk	To winding of Coax Switch A22K1
A18C	1	*	wht-grn-blu	From filter C17 and contacts of relay K3
	2		wht-yel-vio	From T2-14
	3		wht-yel-blu	To -200 V dc regulator via A19B-20
	4		wht-yel-grn	From T2-13
	5		wht-grn-vio	To -200 V dc regulator via A19B-16
	6		wht-yel-grn	From T2-11
	7		wht-red-gra	From T2-10
	8		wht-blk-red	To +C15, TB2, and + return of -200 V dc regulator
	9		wht-red-gra	From T2-8
	10		wht-orn-gra	From T2-7
	11		wht-red	To +C14, TB2, and + return of +150 V dc regulator
	12		wht-orn-gra	From T2-5

* Individual slide-on connector. ** Solder connection. ‡ Slide-on clip connector.



Figure

1. Resistanc
2. Helix Ove
3. All relays
4. Other T2
5. T3 second
6. Terminal etc., on
7. Dial-illun
8. Power re
9. -6.3VDC
10. Other tes matics. +300V are Bd TB2.

Figure 7-38

PRIMARY POWER SCHEMATIC, 8551B

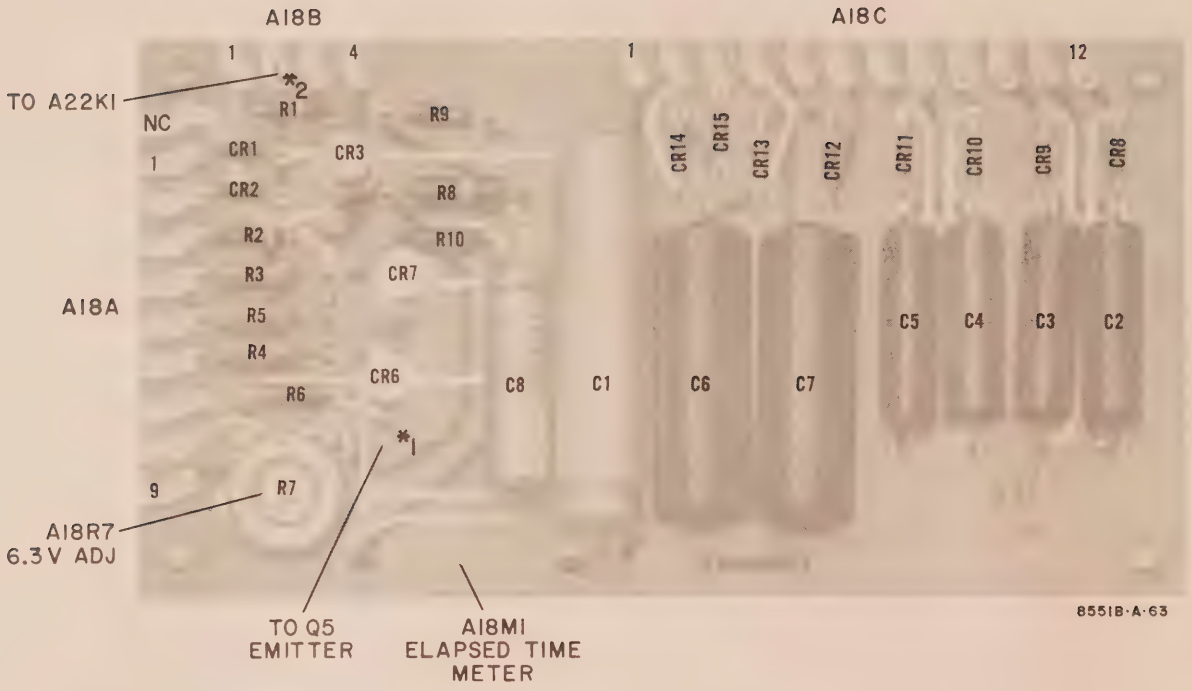
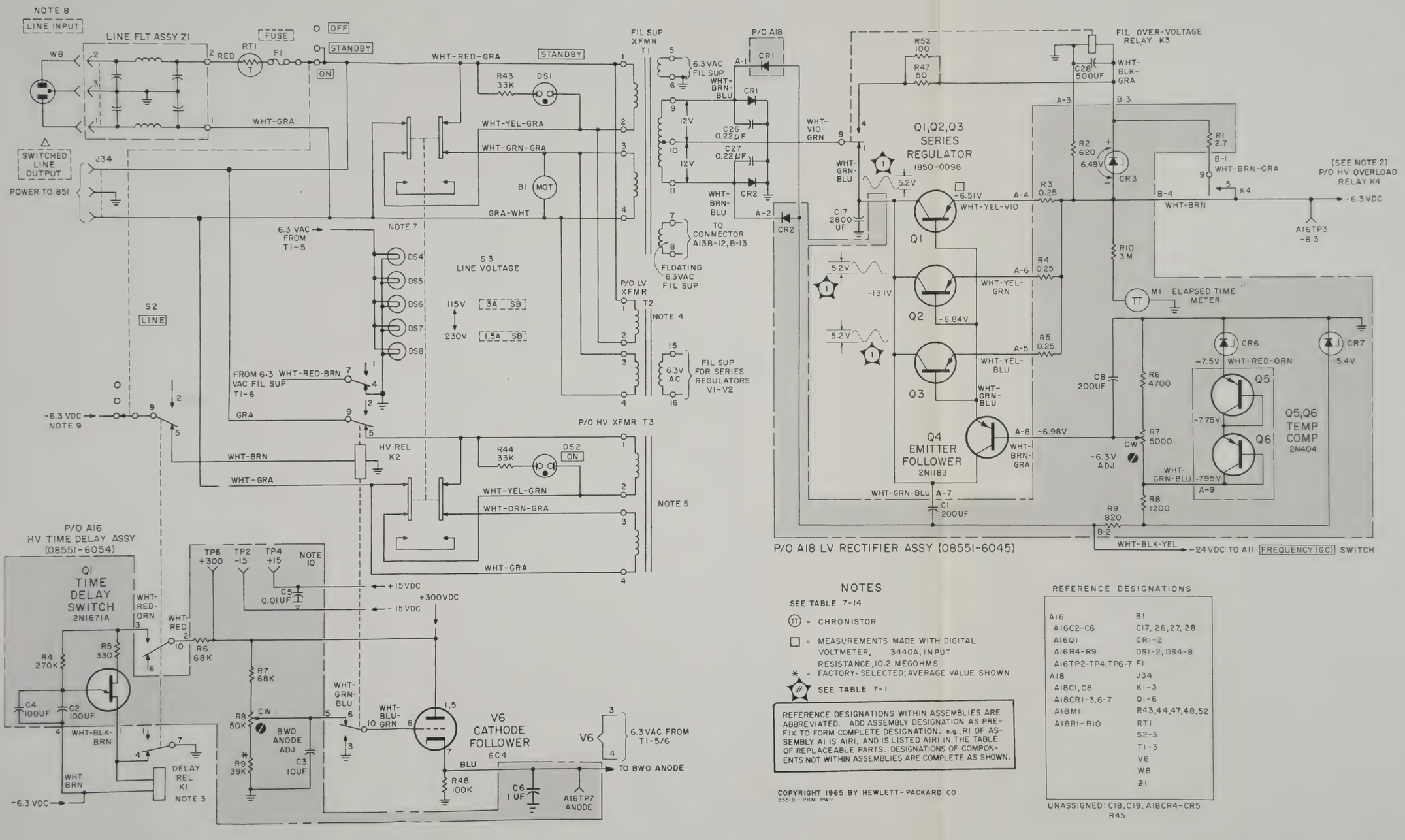


Figure 7-36. Circuit Board for LV Rectifier Assembly A18

Table 7-13. Connections, A18 LV Rectifier Assembly

Conn	Pin. No.	Mates With	Color Code	Connection
A18A	1	*	wht-blu-brn	From T1-9 and CR1
	2		wht-blu-brn	From T1-11 and CR2
	3		blk	Chassis ground, to winding of relay K3
	4		wht-yel-vio	From Q1 emitter
	5		wht-yel-blu	From Q3 emitter
	6		wht-yel-grn	From Q2 emitter
	7		wht-grn-blu	To Q1-Q2-Q3-Q4 collector
	8		wht-brn-gra	To Q4 base
	9		wht-grn-blu	To Q6 collector and base
**1			wht-red-orn	To Q5 emitter
A18B	1	*	wht-brn-gra	From relay K4 make contacts and -6.3 V dc bus
	2		wht-blk-yel	-24 V dc supply
	3		wht-blk-gra	To winding of relay K3
	4		wht-brn	-6.3 V dc supply
‡2			wht-yel-blk	To winding of Coax Switch A22K1
A18C	1	*	wht-grn-blu	From filter C17 and contacts of relay K3
	2		wht-yel-vio	From T2-14
	3		wht-yel-blu	To -200 V dc regulator via A19B-20
	4		wht-yel-grn	From T2-13
	5		wht-grn-vio	To -200 V dc regulator via A19B-16
	6		wht-yel-grn	From T2-11
	7		wht-red-gra	From T2-10
	8		wht-blk-red	To +C15, TB2, and + return of -200 V dc regulator
	9		wht-red-gra	From T2-8
	10		wht-orn-gra	From T2-7
	11		wht-red	To +C14, TB2, and + return of +150 V dc regulator
	12		wht-orn-gra	From T2-5

* Individual slide-on connector. ** Solder connection. ‡ Slide-on clip connector.



NOTES

SEE TABLE 7-14

(TT) = CHRONISTOR

□ = MEASUREMENTS MADE WITH DIGITAL VOLTMETER, 3440A, INPUT RESISTANCE, 10.2 MEGOHMS

* = FACTORY-SELECTED; AVERAGE VALUE SHOWN

(#) SEE TABLE 7-1

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION. e.g., R1 OF ASSEMBLY A1 IS A1R1, AND IS LISTED A1R1 IN THE TABLE OF REPLACEABLE PARTS. DESIGNATIONS OF COMPONENTS NOT WITHIN ASSEMBLIES ARE COMPLETE AS SHOWN.

REFERENCE DESIGNATIONS

A16	B1
A16C2-C6	C17, 26, 27, 28
A16Q1	CR1-2
A16R4-R9	DS1-2, DS4-8
A16TP2-TP4, TP6-7	F1
A18	J34
A18C1, C8	K1-3
A18CR1-3, 6-7	Q1-6
A18M1	R43, 44, 47, 48, 52
A18R1-R10	RT1
	S2-3
	T1-3
	V6
	W8
	Z1

UNASSIGNED: C18, C19, A18CR4-CR5 R45

Figure 7-38. Primary Power Schematic, 8551B

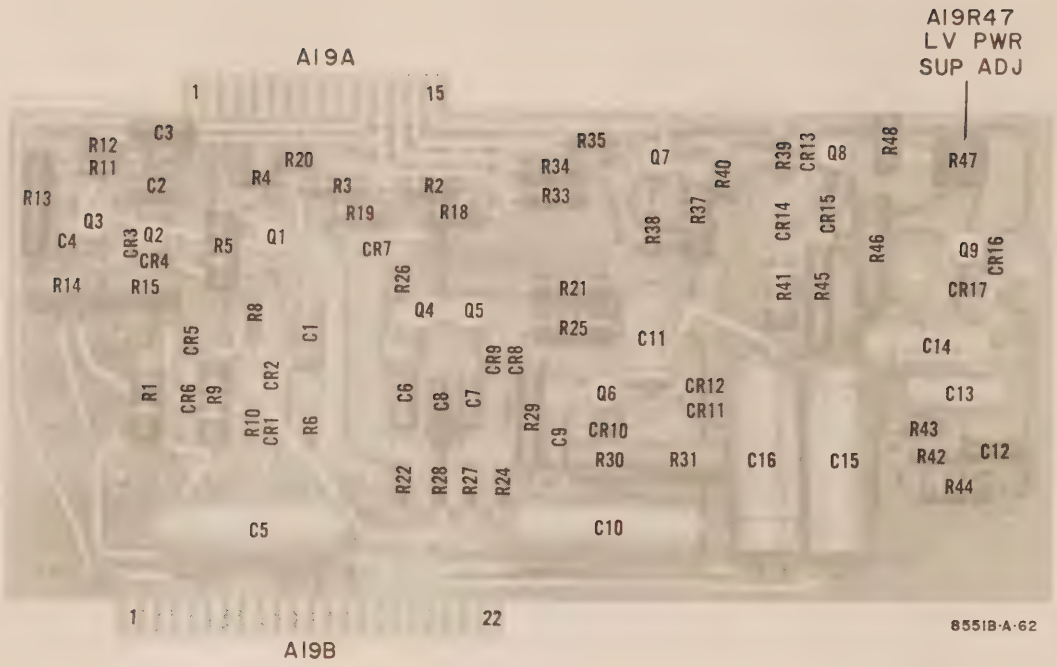


Figure 7-39. Component Side, Circuit Board for LV Power Supply A19

Table 7-15. Connections, A19 LV Power Supply Board

Conn.	Pin No.	Mates With	Color Code	Connection
A19A	1	XA19A		Unoccupied
	2		wht-grn	Base, A20Q2
	3		wht-yel	Emitter, A20Q2
	4		wht-blu	Collector, A20Q1
	5		wht-grn	Base, A20Q1
	6			Unoccupied
	7		wht-yel	Emitter, A20Q4
	8			Unoccupied
	9		wht-grn	Base, A20Q3
	10		wht-grn	Base, A20Q4
	11		wht-blu	Collector, A20Q3
	12		wht-blu	Collector, A20Q5
	13		wht-grn	Base, A20Q5
	14		wht-yel	Emitter, A20Q6
	15		wht-grn	Base, A20Q6
A19B	1	XA19B		Unoccupied
	2		wht-red	Regulated +300 V dc supply, to TB1
	3			Unoccupied
	4			Unoccupied

02435-1

Figure 7-41
LV POWER SUPPLY SCHEMATIC, 8551B

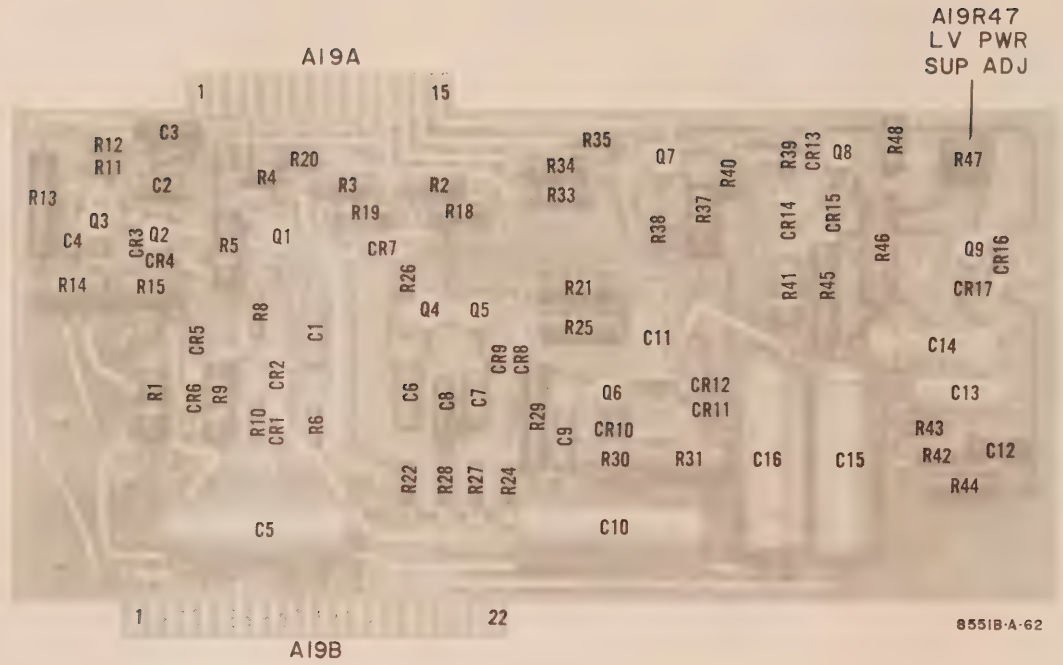
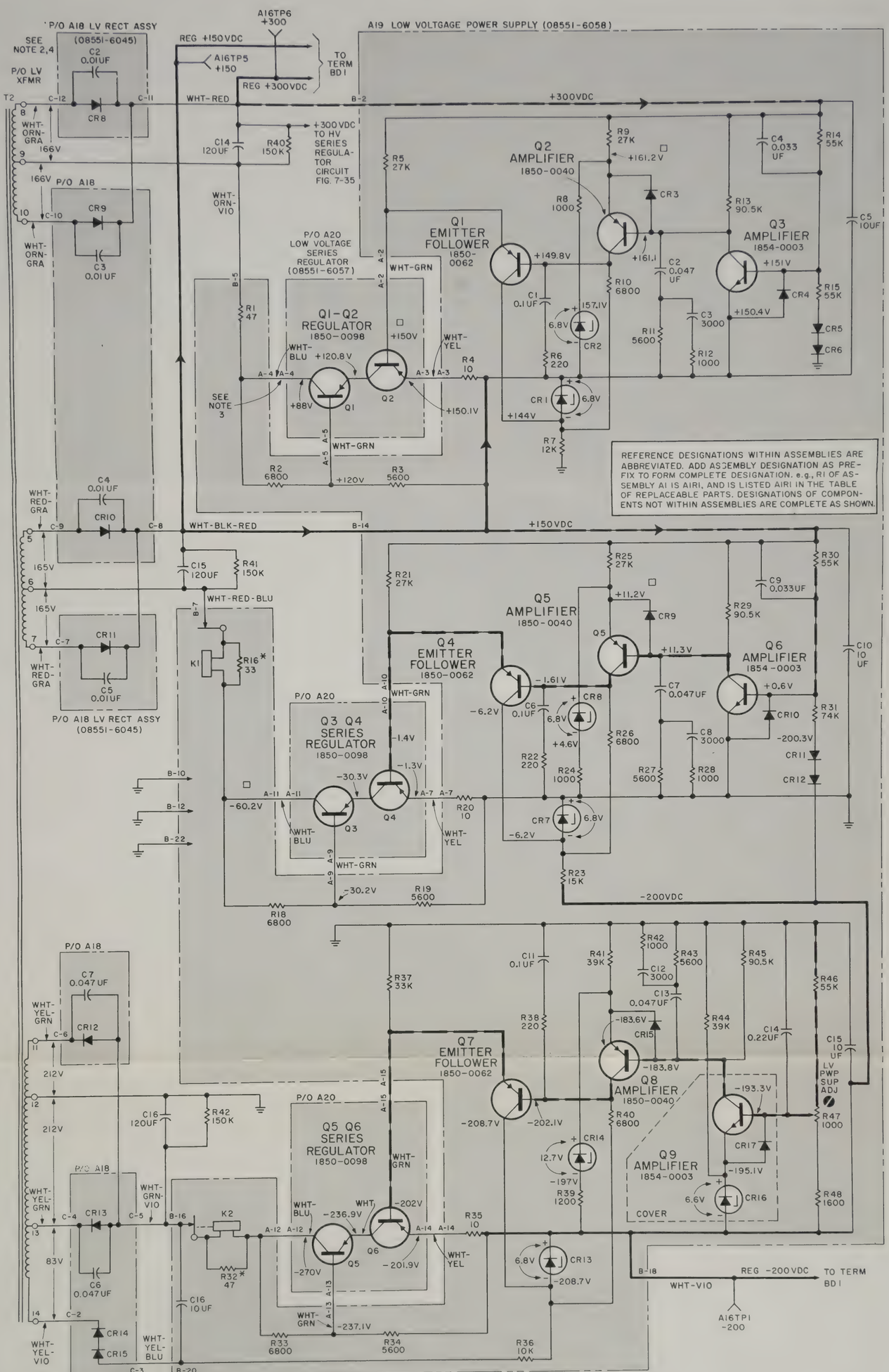


Figure 7-39. Component Side, Circuit Board for LV Power Supply A19

Table 7-15. Connections, A19 LV Power Supply Board

Conn.	Pin No.	Mates With	Color Code	Connection
A19A	1	XA19A		Unoccupied
	2		wht-grn	Base, A20Q2
	3		wht-yel	Emitter, A20Q2
	4		wht-blu	Collector, A20Q1
	5		wht-grn	Base, A20Q1
	6			Unoccupied
	7		wht-yel	Emitter, A20Q4
	8			Unoccupied
	9		wht-grn	Base, A20Q3
	10		wht-grn	Base, A20Q4
	11		wht-blu	Collector, A20Q3
	12		wht-blu	Collector, A20Q5
	13		wht-grn	Base, A20Q5
	14		wht-yel	Emitter, A20Q6
	15		wht-grn	Base, A20Q6
A19B	1	XA19B		Unoccupied
	2		wht-red	Regulated +300 V dc supply, to TB1
	3			Unoccupied
	4			Unoccupied



REFERENCE DESIGNATIONS

A16TP1, TP5, TP6	A20 Q1-6
A18 C, C2-7, CR8-15	C14-16, R40-42, T2
A19 A, B, C1-16, CR1-17, K1-K2, Q1-Q9, R1-48	

UNASSIGNED: R17

NOTES

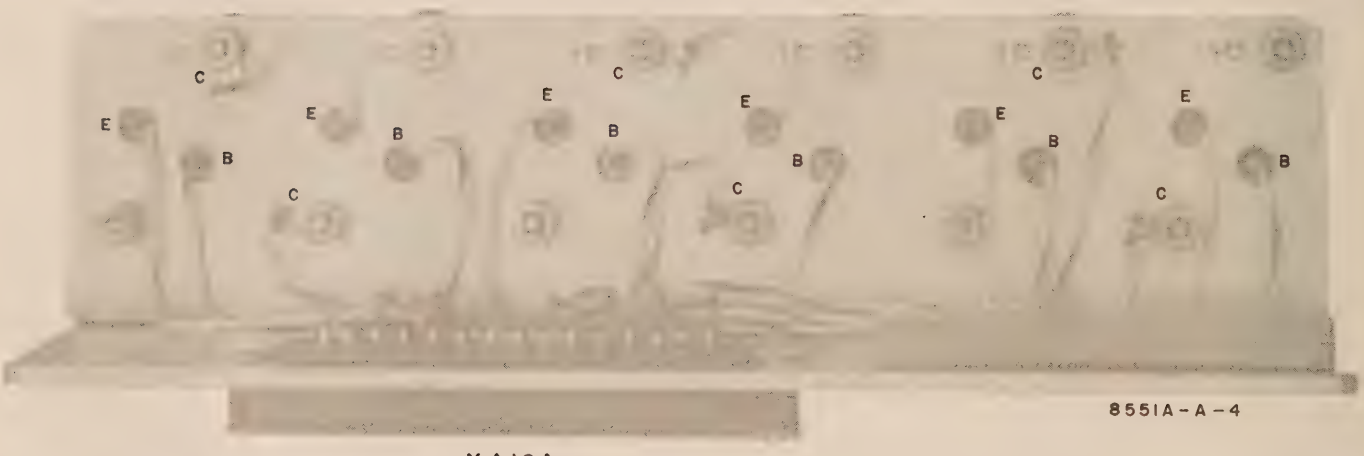
1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS UNLESS NOTED OTHERWISE.
2. TERMINALS ON CONNECTOR A18C ARE DESIGNATED C-4, C-5, ETC; MATE WITH INDIVIDUAL CONNECTORS ON CONDUCTORS.
3. CONNECTOR XA19A ON ASSY A20 MATES WITH CONNECTOR A19A ON ASSY A19; TERMINALS ON BOTH CONNECTORS DESIGNATED A-2, A-3, ETC.
4. T2 PRIMARY WDG SHOWN ON PRIMARY POWER DIAG.
5. CONNECTOR A19B MATES WITH CONNECTOR XA19B ON THE CHASSIS; TERMINALS ON BOTH CONNECTORS DESIGNATED B-2, B-10, ETC.

□ MEASUREMENTS MADE WITH DIGITAL VOLTMETER -*hp*- 3440A, INPUT RESISTANCE 10.2 MEGOHMS.

* FACTORY SELECTED; AVG VALUE SHOWN.

Figure 7-41. LV Power Supply Schematic, 8551B

Figure 7-42. Top View, LV Series Regulator Assembly A20



XA19A

Figure 7-43. Bottom View, LV Series Regulator Assembly A20

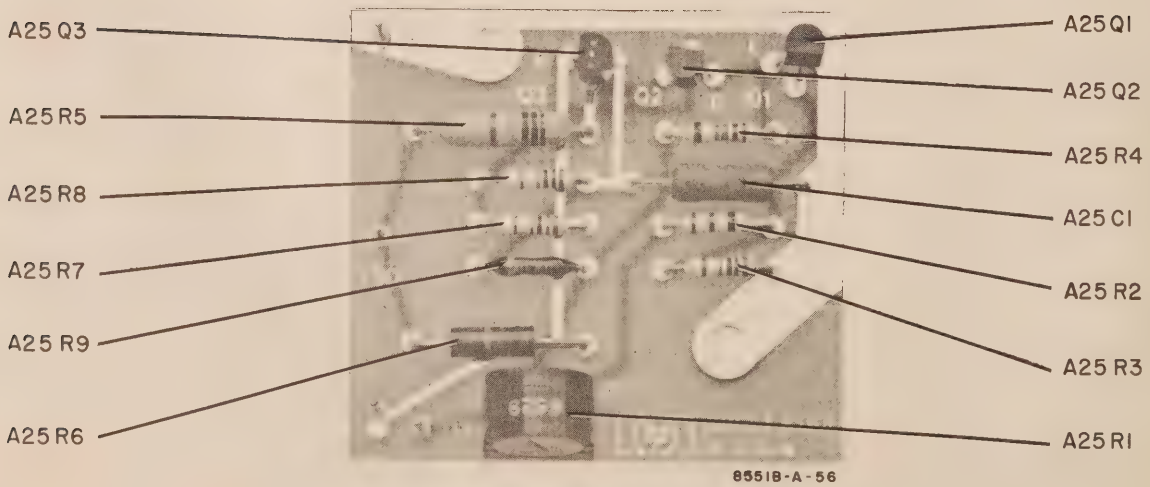


Figure 7-44. Component Side, Circuit Board for Bias Generator A25

WARRANTY CLAIM AND ADJUSTMENT PROCEDURE

for microwave tubes supplied by the
HEWLETT-PACKARD COMPANY
for use in Hewlett-Packard instruments

The procedure described below is for use within the United States. For warranty claims arising outside the U.S.A., before returning the tube, fill out the form on the reverse side and send it with a request for shipping instructions to your nearest Hewlett-Packard Sales and Service Office or to:

(in Western Europe)

Hewlett-Packard S.A.
54 Route des Acacias
Geneva, Switzerland
Telephone: (022) 42.81.50
Telex: 2.24.86
Cable: HEWPACKSA

(Rest of World)

Hewlett-Packard Co.
International Marketing Dept.
1501 Page Mill Road
Palo Alto, California, 94304, U.S.A.
Telephone: (415) 326-7000
Telex: 033811
Cable: HEWPACK

Microwave tubes supplied by the Hewlett-Packard Company, either as original or replacement, for use in Hewlett-Packard instruments are actually warranted by the tube manufacturer and not by Hewlett-Packard. However, all warranty claims on tubes obtained from us either as original or replacement will be processed by Hewlett-Packard.

In the event of failure you should purchase a new tube immediately without regard to first returning the defective tube to Hewlett-Packard because old tubes will not be repaired. Credit allowances will be passed on to you upon receipt of the defective tube.

For your convenience, warranty claims for all microwave tubes supplied by the Hewlett-Packard Company may be made on this single form; merely fill out the information on the reverse side and return this from, along with the defective tube, to your Hewlett-Packard Sales and Service Office or to Hewlett-Packard. Please be sure each space on the form is filled in--lack of complete information may delay processing of your claim.

Each tube manufacturer has his own warranty policy. Copies of individual Conditions of Warranty are available from your Hewlett-Packard Sales and Service Office or from the Hewlett-Packard Company.

SHIPPING INSTRUCTIONS

The following instructions are included to aid you in preventing damage in transit. Package your tube carefully--no allowance can be made on broken tubes.

1. Carefully wrap tube in 1/4-inch thick cellulosic cushioning, cotton batting, or other soft padding material. Cable assemblies and other accessories not rigidly mounted to the tube should be padded and wrapped separately to prevent damage to the tube during shipment.
2. Remove Elapsed Time Meter A18M1 from LV Rectifier Assembly A18 (see Figure 7-36). Package in suitable container to prevent loss or damage in transit. Pad, wrap and identify elapsed time meter package. Tape tube and meter packages together and wrap in heavy Kraft paper.
3. Pack in a rigid container which is at least 4 inches larger than the tube in each dimension.
4. Surround the tube with at least 2 inches of shock absorbing material. Be certain that the packing is tight all around the tube.
5. Tubes returned from outside the continental United States should be packed in a wooden box.
6. Mark container FRAGILE and ship prepaid via Air freight or Railway Express. Do not ship via Parcel Post or Air Parcel Post since experience has shown that fragile items are more apt to be damaged when shipped by these means.

Note

Tubes with permanent magnets can interfere with magnetic compasses.
For air shipment plainly mark container: "MAGNETIZED MATERIAL"

In warranty tubes purchased from Hewlett-Packard may be returned, with a completed warranty Claim Form, to your local Hewlett-Packard Sales and Service Office, or to:

Hewlett-Packard Company
Eastern Service Center
Green Pond Road
Rockaway, New Jersey, 07866
USA

Hewlett-Packard Company
Western Service Center
333 Logue Ave.
Mountain View, California 94040
USA

MICROWAVE TUBE WARRANTY CLAIM
INFORMATION FORM

IMPORTANT: Please answer all questions fully -- insufficient information may delay processing of your claim.

FROM: (Tube Owner)

Company _____

Address _____

_____

_____

Tube type _____

Tube serial No. _____

Tube mfr. _____

Use in ℌ Model _____

Instrument serial no. _____

Tube is Original ( ) or Replacement ( )

Date tube received _____

Date first tested _____

Date placed in service _____

Date of failure _____

Date _____

FOR FURTHER INFORMATION CONTACT:

Name _____

Title _____

Company _____

Address _____

_____

Tube purchased from _____

_____

On P. O. number _____

Hours use per day (average) _____

Number of days in service _____

Total hours filament operation _____

SYMPTOMS: (Please describe conditions prior to and at time of failure, along with description of tube's defect, if known) _____

_____

_____

_____

Were there other circuit component failures at time of failure? Which ones?

_____

_____

Signature _____

Title _____

10/15/62
01153-3

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